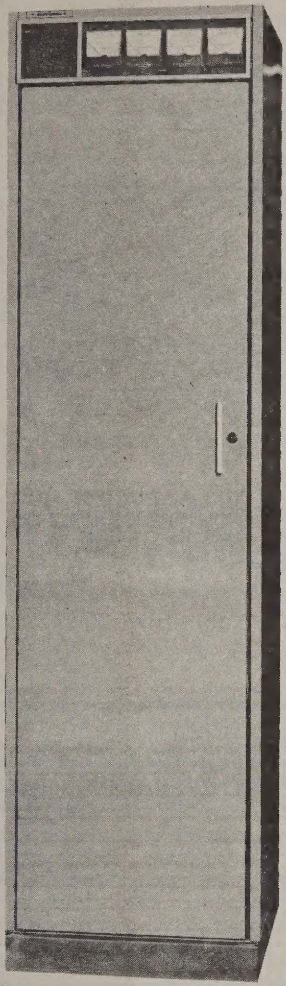
MOTOROLA

BASE STATION

TONE REMOTE CONTROL
FM TWO-WAY RADIO
450-470 MHz 250/275 W RF POWER



THIS INSTRUCTION MANUAL CONSISTS OF
THE FOLLOWING PARTS

MOTOROLA INC.
ENGINEERING PUBLICATIONS
Communications Division
1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

3/21/72-SK

68P81011E75
Issue - A

MOTOROLA

MODEL CHART

TONE REMOTE CONTROL BASE STATIONS

450-470 MHz 250/275 W RF POWER

CODE:

[X] = ONE ITEM INCLUDED

*REPRESENTS A SERIES OF MODELS AND NOT A SPECIFIC MODEL. THE SPECIFIC MODEL NUMBER STAMPED ON THE CHASSIS CORRESPONDS WITH A SPECIFIC CARRIER FREQUENCY RANGE.

ITEM	DESCRIPTION	B94MSB-1106A	B94MSB-3106A
	SQUELCH	CARRIER SQUELCH	"PRIVATE-LINE" TONE-CODED SQUELCH
	XMTR. FREQS.	1	1
	RCVR. FREQS.	1	1
	RF POWER	275 W	275 W
	CHANNEL SPACING	25 kHz	25 kHz
*TRE1150AB	RECEIVER, CARRIER SQUELCH	X	
*TRE1150AF	RECEIVER, "PRIVATE-LINE" TONE-CODED SQUELCH		X
*TTE1130AA	TRANSMITTER	X	X
TLE1350A	DRIVER AMPLIFIER	X	X
TPN1089A	POWER SUPPLY	X	X
TLN8847A	"PL" TONE OSCILLATOR		X
TCN1094A	REMOTE CONTROL CHASSIS	X	X
TLN1172A	LINE DRIVER MODULE	X	X
TLN1245A	GUARD-TONE DECODER MODULE	X	X
TLN1173A	STATION LOGIC MODULE	X	X
TLN1243A	F1 CONTROL MODULE	X	
TLN1244A	F1-"PL" DISABLE CONTROL MODULE		X
TPN1090A	HIGH VOLTAGE POWER SUPPLY	X	X
TLN6943A	TRANSFORMER KIT	X	X
TLE1360A	POWER AMPLIFIER	X	X
THN6121A	CABINET	X	X
TLN4433A	CABINET ACCESSORY KIT	X	X
TLN8036A	BLANK CHASSIS	X	X
TLN4498AV	JUNCTION BOX	X	X
TLN4499A	BLOWER AND HARMONIC FILTER	X	X
TLN4500A	METER PANEL	X	X
TLN4501A	ANTENNA RELAY	X	X
TKN6498A	CABLE KIT	X	X
TLN1190A	CHANNEL ELEMENT (TRANSMITTER)	X	X
CER106B	CHANNEL ELEMENT (RECEIVER)	X	X
TLN6824A	"VIBRASENDER" RESONANT REED		X
TLN8381A	"VIBRASPONDER" RESONANT REED		X
TLN8805A	TUNING TOOL KIT	X	X
TLN8799A	CIRCUIT BOARD SERVICING KIT	X	X
TLN1386A	FILTER AND PANEL	X	X
TKN6496A	COAXIAL CABLE KIT	X	X

EPS-5331-O

GUARANTEED PERFORMANCE SPECIFICATIONS

GENERAL

AC INPUT REQUIREMENTS	Receive: 6 amps Transmit: 12 amps @ 120 V ac 50/60 Hz
FREQUENCY RANGE	450-470 MHz
CABINET DIMENSIONS	21-/34" wide x 82" high x 20-1/4" deep
WEIGHT	550 lbs.

TRANSMITTER

RF POWER OUTPUT	250/275 watts
OUTPUT IMPEDANCE	50 ohms
SPURIOUS & HARMONIC EMISSIONS	More than 85 dB below carrier
FREQUENCY STABILITY	Temperature-compensated channel element maintains carrier within ±.0002% of assigned center frequency from -30°C to +60°C (+25°C reference).
MODULATION	16F3: ±5 kHz for 100% at 1000 Hz
AUDIO SENSITIVITY	.165 volt ±3 dB at microphone terminal or -20 dB at the control line terminal for 2/3 maximum deviation at 1000 Hz
FM NOISE	-55 dB below 2/3 system deviation at 1000 Hz
AUDIO RESPONSE	+1, -3 dB of 6 dB/octave pre-emphasis characteristic from 300-3000 Hz referenced to 1000 Hz
AUDIO DISTORTION	Less than 3% at 1000 Hz for 2/3 system deviation. 300 to 3000 Hz.

RECEIVER

CHANNEL SPACING	25 kHz
SELECTIVITY EIA SINAD	-90 dB
EIA SINAD INTERMODULATION	-80 dB; -75 dB with optional preamplifier
EIA MODULATION ACCEPTANCE	±7 kHz minimum
SENSITIVITY	Less than .5 microvolt for 20 dB quieting; less than .35 microvolt for EIA SINAD; less than .25 microvolt for 20 dB quieting; less than .175 microvolt for EIA SINAD with optional preamplifier.
FREQUENCY STABILITY	Temperature-compensated AFC channel element maintains oscillator frequency within ±.0002% of reference frequency from -30°C to +60°C ambient (+25°C reference).
SPURIOUS & IMAGE REJECTION	More than 100 dB. More than 90 dB with optional preamplifier
SQUELCH	Carrier Squelch: Noise compensated type, adjustable sensitivity, threshold sensitivity of 0.25 microvolt or less (Patent No. 2343115 other patents pending). "Private-Line" Tone-Coded Squelch: Also includes a tone-operated squelch circuit with a fixed sensitivity of 0.25 microvolt or less (Patent No. 2688059). With preamplifier, both types have sensitivity of 0.15 microvolt or less.
AUDIO OUTPUT	Line output: +18 dBm at 600 ohms; less than 3% distortion. Speaker: 5 watts at 3.2 ohms; less than 5% distortion at 1000 Hz.
AUDIO RESPONSE	Line output: +1, -3 dB of 6 dB/octave de-emphasis characteristic from 300-3000 Hz; Hum & Noise: -50 dB Speaker: +1, -3 dB of 6 dB/octave de-emphasis characteristic from 300-3000 Hz

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

FCC LICENSE DESIGNATION: CC4101CF 250 Watt Output
CC4101C 275 Watt Output

EPS-4014-A

FOREWORD

SCOPE OF INSTRUCTION MANUAL

This manual offers descriptive and service information for the radios described in it. Service diagrams, parts lists, and printed circuit board details are also included.

NOMENCLATURE

Motorola radio equipment is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
The Model TRD1432AA becomes
TRD1432AA-1 with the first revision.

This chassis number complete with revision numeral, if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

NATIONAL
MOTOROLA COMMUNICATIONS
SERVICE

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
1301 E. Algonquin Road, Schaumburg, Ill. 60172

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U.S. PATENTS:

RE-24,815	2,834,879	3,059,184	3,204,202	3,306,990	3,387,270
RE-26,079	2,883,521	3,061,785	3,205,455	3,307,051	3,400,219
RE-26,361	2,888,652	3,070,737	3,218,587	3,307,121	3,409,841
2,626,384	2,899,547	3,070,748	3,223,953	3,323,065	3,414,881
2,637,782	2,901,601	3,083,332	3,233,243	3,324,408	3,416,032
2,650,333	2,912,573	3,087,117	3,234,469	3,327,215	3,424,854
2,688,059	2,918,571	3,087,998	3,247,475	3,328,695	3,424,983
2,691,094	2,924,705	3,087,999	3,250,997	3,328,727	3,430,171
2,691,560	2,925,562	3,091,736	3,250,999	3,333,151	3,431,486
2,699,425	2,938,082	3,094,293	3,256,497	3,333,911	3,437,838
2,705,281	2,963,577	3,101,441	3,263,172	3,334,293	3,437,934
2,731,555	2,966,585	3,119,093	3,273,083	3,335,405	3,441,854
2,738,466	2,974,221	3,126,514	3,275,938	3,336,533	3,447,133
2,740,891	2,984,740	3,128,431	3,281,697	3,341,777	3,448,342
2,743,361	2,994,844	3,129,396	3,284,714	3,345,568	3,449,680
2,759,052	3,009,115	3,131,354	3,289,098	3,345,569	3,453,521
2,759,103	3,014,127	3,149,317	3,292,085	3,345,573	3,454,927
2,777,950	3,027,454	3,175,183	3,293,644	3,348,148	3,458,664
2,799,010	3,027,455	3,175,187	3,300,723	3,355,533	3,465,294
2,808,507	3,039,081	3,175,193	3,304,501	3,355,709	3,469,191
2,809,236	3,041,550	3,183,382	3,304,503	3,369,597	3,471,796
2,830,200	3,048,659	3,191,123	3,305,779	3,370,236	3,471,805
2,833,994	3,048,747			3,373,379	3,473,152

Other U.S. Patents Pending

REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

Motorola maintains parts and service depots and authorized service stations strategically located throughout the country. These facilities are fully equipped to give the finest service. Orders for all parts except crystals, channel elements, and "Vibrasender" and "Vibrasponder" resonant reeds should be sent to the nearest parts and service depot. Orders for crystals, channel elements and reeds should be sent to the factory address listed below.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and assure delivery of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal and channel element orders should specify the crystal or channel element type number, crystal frequency, carrier frequency, and the chassis model number in which the part is used.

Orders for "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency and should identify the owner/operator of the communications systems in which these items are to be used.

PARTS AND SERVICE LOCATIONS

Motorola, Inc.

Parts and Service Depot

2333 Utah Ave. El Segundo, California 90245

1170 Chess Drive, San Mateo, California 94404

Lake Mirror Road, Forest Park, Georgia 30050

1313 E. Algonquin Road, Schaumburg, Ill. 60172

85 Harristown Road, Glen Rock, New Jersey 07452

12955 Snow Road, Parma, Ohio 44130

3220 Belt Line Road, Dallas, Texas 75234

FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT AND RESONANT REED ORDERS

AIR MAIL ORDERS	REGULAR MAIL ORDERS AND CORRESPONDENCE
Motorola, Inc. Component Service Department P.O. Box 66191 O'Hare International Airport Chicago Ill. 60666	Motorola, Inc. Component Service Department 4545 West Augusta Boulevard Chicago, Illinois 60651

68P81001E43-E

STATION PACKAGE

FOR

TONE REMOTE CONTROL BASE STATION

450-470 MHz 250/275 W RF POWER

CONTENTS OF PACKAGE

1. INTRODUCTION

This manual describes two Motorola transistorized upright base station models designed for remote audio tone line control operation. The model complement of these two continuous duty stations is shown in the model chart at the front of this manual.

The stations employ completely transistorized receivers, exciters, power supplies, and control units. Only the driver amplifier and high voltage amplifier stages of the transmitter use tubes. The advantages of the transistor -- low current requirements, reliability, light weight, compact size and low maintenance requirements -- are fully utilized. Solid-state switching is used except for the antenna relay and interlock relays. Current requirements are lowered by the use of unheated, temperature compensated, plug-in, oscillator modules (channel elements) for frequency control. A blower is provided to cool the high voltage amplifier tubes.

The base station is constructed so all tuning and metering controls are accessible without interrupting communications. There is no interlock on the front door since there are no high voltages present on the front panels. Local control facilities are provided for servicing purposes. The base station cabinets are designed with a basic frame construction covered by a sheet metal outer covering. The tops, sides, and doors are easily removed and replaced.

2. "PRIVATE-LINE" TONE-CODED SQUELCH OR CARRIER SQUELCH

a. "Private-Line" Tone-Coded Squelch

The use of "Private-Line" tone-coded squelch stations improves radio communications especially when operating under crowded channel conditions. Several "Private-Line" (PL) networks can use the same rf carrier frequency in the same area. Receivers will accept only the messages transmitted by units in the same net. The speaker will remain quiet during all other transmissions; personnel will not have to listen to transmissions originating outside their PL network.

"Private-Line" transmitters are modulated by a continuous sub-audible tone in addition to the voice modulation. The receivers accept only signals which are modulated with the correct tone and reject all others unless the PL squelch circuit is disabled. At that time, the noise operated squelch circuit is placed in operation and all on-frequency signals are heard. When the PL squelch circuit is activated, the noise squelch circuit is disabled.

b. Carrier Squelch

In carrier squelch stations all transmissions on a specific frequency are received. The receiver incorporates a noise squelch circuit that eliminates disturbing noise when no transmissions are being received.

3. DESCRIPTION OF ITEMS

a. Receiver

The completely transistorized receivers in these stations are crystal-controlled dual conversion models. Audio output for local speaker operation and +14 dBm of audio to the control line are provided with separate adjustments.

The rf preselector and a sealed life-time guaranteed "Permakay"® filter in the i-f stages

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determine the excellent bandwidth and selectivity characteristics of the receiver. Temperature-compensated, plug-in crystal oscillator modules (channel elements) provide excellent frequency stability without the use of crystal ovens. Disturbing noise during periods when no messages are being received is eliminated by noise actuated squelch circuitry.

b. Transmitter

Circuits include an unheated, temperature-compensated crystal oscillator module (channel element). The channel elements used in these stations are high stability channel elements which provide ±0.0002% frequency stability. Also included are; transistorized audio amplifier and IDC ("Instantaneous Deviation Control") circuit, varactor phase modulator, completely transistorized exciter (frequency multipliers and amplifiers), and tube-type driver and power amplifier stages. A high level of harmonic frequency attenuation is achieved in a harmonic filter at the transmitter output.

c. Power Supplies

The power supplies provide all voltages necessary for the operation of the station. These units use solid-state circuits for all voltage and function switching with the exception of the two relays in the rear door interlock circuit.

d. Meter Panels

This panel includes meters that can be used to indicate the power amplifier plate voltage, upper and lower tube plate currents, and the grid current. Two indicator lamps are provided on the meter panel. The amber lamp indicates when power is applied to the station, and the red lamp indicates when the transmitter is keyed.

e. Power and Audio Line Junction Box

The junction box is provided as a convenient means of connecting the ac input power line and the control lines used for remote operation of the station. Two ac receptacles and the main station fuse are located on the junction box in the 120 V ac models while the tri-power models (120/220/240 V ac) provide a main station power on-off switch and two fuses on the junction box.

f. Remote Control Unit

The remote control unit consists of a remote control chassis and solid-state, plug-in modules which permit the station to be operated from a remote location and performs various control or operational functions for the station. Audio tones generated at a remote location are carried over wire lines to the station's remote control chassis to implement the desired type of operation.

A Motorola Tone Remote Control Console, Model T1367AM (or equivalent) is required at the control location for these stations. It must provide:

a. Microphone audio and accept receiver audio from a 600-ohm line.

b. 2175-Hz Guard Tone to prepare the station for accepting function tones.

c. 1950-Hz tone for transmitter keying.

d. 2050-Hz tone for PL disabling function (PL models only).

The remote control chassis and its modules convert the tone bursts into switching functions.

The basic remote control chassis includes the following modules:

(1) Line Driver Module

This module amplifies the receiver audio which is routed to the remote control point over wire lines, couples transmit audio from the remote control point to the "XCTR LEVEL" control in the station logic module, and amplifies the audio from the local speaker for intercom applications. It also separates the dc line current from the incoming audio.

(2) F1 Control

This module provides a switched ground to the transmitter channel element when it detects a 1950-Hz tone, and provides PL disabling of the receiver when it detects a 2050-Hz tone (PL models only).

(3) Station Logic

This module provides sequencing, timing, and control functions for remote operation of the station. It also amplifies line audio to the proper level for the exciter.

(4) Guard Tone Decoder Module

This module converts a 2175-Hz guard tone signal to a line push-to-talk voltage. It also amplifies, processes and distributes the function tones to the other function decoders.

(5) Station Local Control

This module provides local control and metering facilities for service and maintenance.

(6) Circuit Board Servicing Kit

This kit is available for extending the module to provide access for service and maintenance without interrupting the power and signal connections when taking readings.

4. DESCRIPTION OF OPTIONAL ITEMS

a. Time-Out Timer Module

This completely transistorized timer is used to turn off the transmitter after a predetermined transmission time. It is adjustable in steps from 1/2 to 8 minutes. Timing is started when the transmitter is keyed and is reset each time the keying circuit is deactivated.

b. 4-Wire Audio Module

An additional line driver module allows use of separate audio line pairs for receiver and transmit audio signals.

c. Single-Tone Decoder Module

This module adapts the station for use in single-tone signalling systems. Such a system may use single-tone frequencies to select a specific function instead of using a current level. Other typical applications for the modules are remote monitoring and control of external signalling devices.

d. Metering Kit

The metering kit permits metering of the receiver, exciter amplifier, and driver amplifier. In addition, the unit provides intercom between the station and the remote control point when adjusting or testing the station.

e. Transmitter Shield Kit

The transmitter shield kit provides additional shielding for the transmitter and helps minimize intermodulation between stations operating in close proximity.

f. Transmitter Only Station

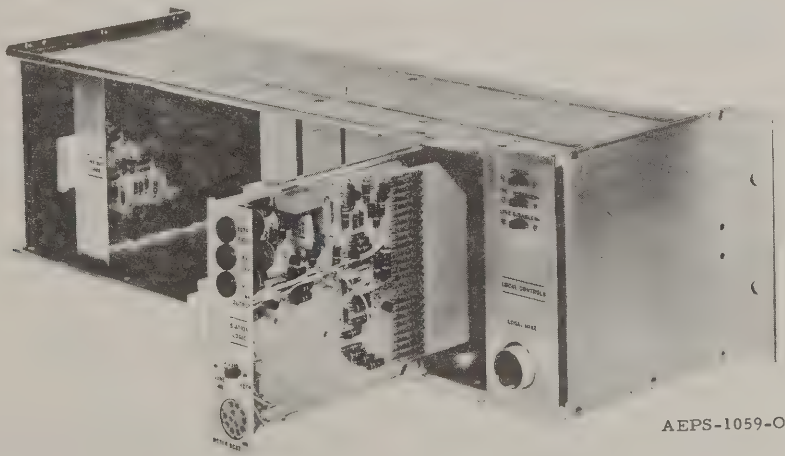
This equipment is available as a "transmitter only" station. The standard transmitter-receiver station is modified for this purpose as follows:

Items Omitted

Receiver
Receiver Channel Element
"Vibrasponder" Resonant Reed (PL Models)
Antenna Relay

Items Added

Blank Chassis, TLN8036A
Ground Plug, TLN4544A
Coaxial Cable, 1V80782A83

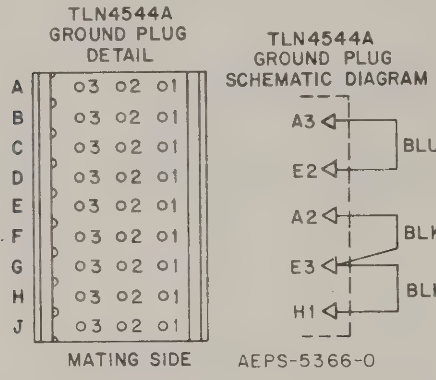

AEPS-1059-O

Module Extended for Service and Maintenance

DESCRIPTION

The "ground plug" does not have any connecting cable. It plugs into the same receptacle on the power supply which was occupied by the receiver power & control plug. The ground plug includes jumper wires to complete circuit paths required for normal operation.

One end of the coaxial cable terminates with a uhf-type female connector (Part No. 9C82442E01) which mounts on the junction box and serves as the antenna receptacle. The other end terminates with an "N"-type male plug (Part No. 28K852527) which connects to the transmitter harmonic filter rf output receptacle.



Ground Plug Detail

g. Other Options

Many other options are available for these stations for particular applications. See your local Motorola representative for complete details.

5. FUNCTIONAL DESCRIPTION

a. General

The basic function of a remote control base station is to allow remote operation of the station at a location that optimizes communications coverage. The station may be located at a considerable distance from the dispatch (control) point. A compatible remote control console must be used at the dispatcher's location to control the station. The console generates audio function tones which are applied to the wire line that terminates at the station. The station's remote control chassis converts these tones into switching functions.

b. Control Line

The overall station operation is illustrated in the functional block diagram attached to this section.

Audio signals and function tones are routed to the line transformer in the remote control chassis. The remote control circuits convert the function tones into signals that are applied to the various modules to enable or inhibit specific functions.

c. Transmitter Turn-On

When a 1950-Hz function tone is applied to the control line, the F1 detector output is applied to the F1 bistable. The output from the bistable provides a ground to the channel element, thus turning it "on".

The high level guard tone activates the remote control circuitry and associated station functions in anticipation of the function tone. The function tone activates the desired mode of operation and completes the cycle except for transmit.

In transmit, after completion of the high level guard tone and function tone, the low level guard tone is applied to the control line as long as the transmit switch is activated. All functions occur simultaneously except the power supply key function which occurs 35 milliseconds after antenna switching.

(1) The F1 oscillator in the exciter-driver chassis is selected by grounding the channel element.

(2) The receiver is muted by supplying a ground to the switch in the squelch circuit.

(3) The antenna relay is energized by completing the ground to one side of the coil.

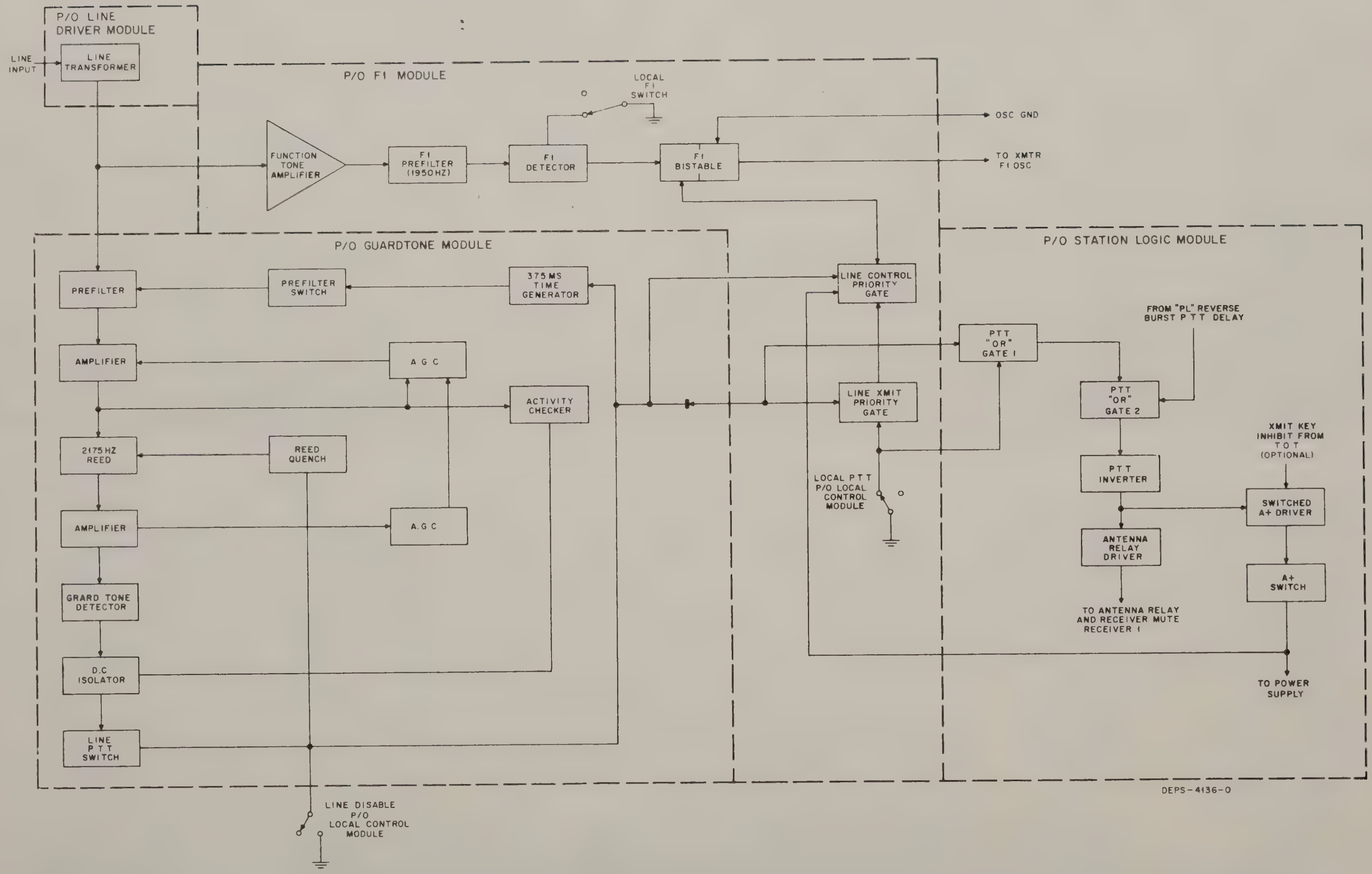
(4) A positive potential is applied to the power supply control circuit to permit the B+ and B++ voltages to be applied to the exciter-driver, driver amplifier, and power amplifier.

d. Transmitter Turn-Off

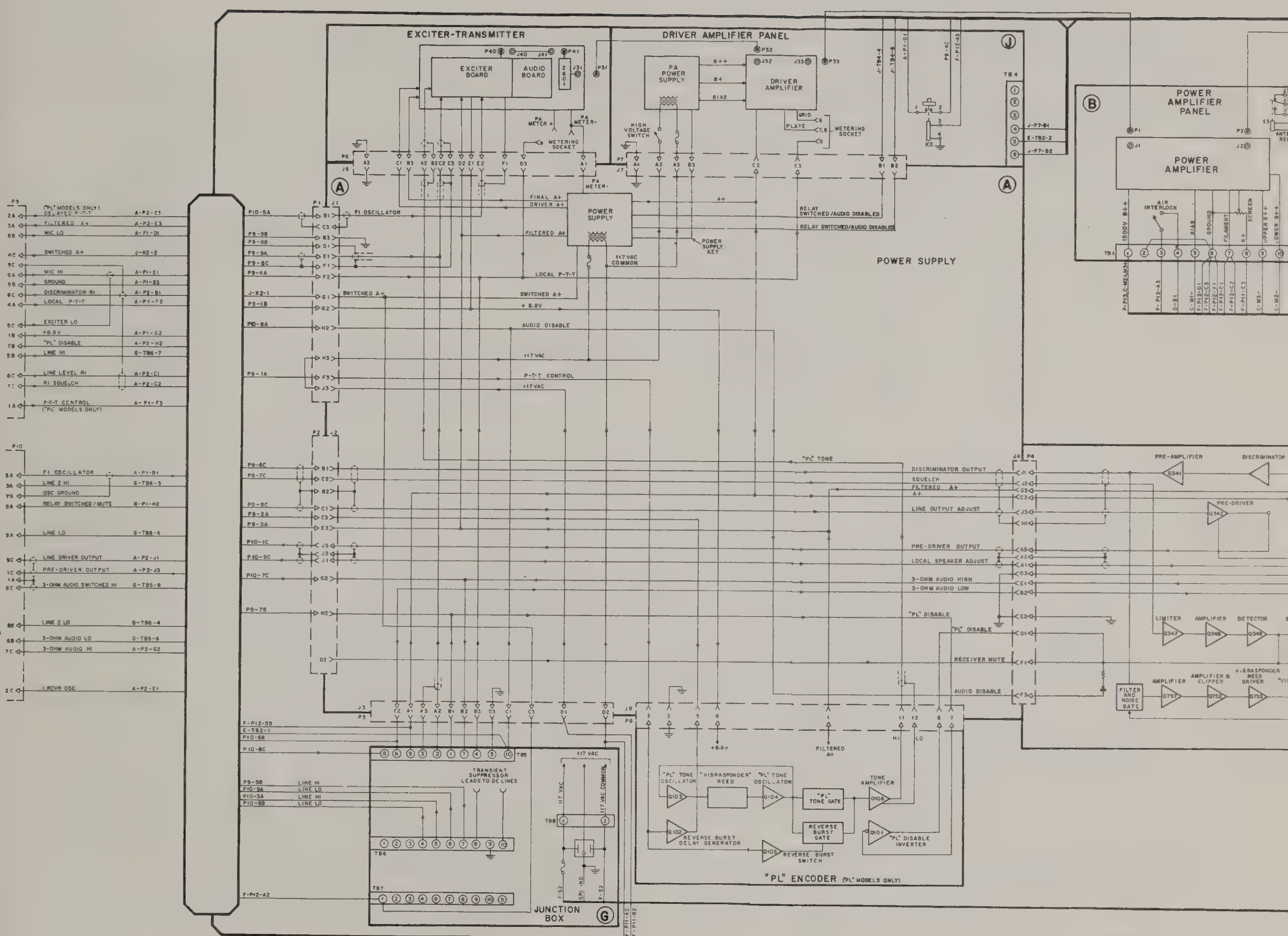
When the low level guard tone is removed from the control lines, all circuits revert to their original state. The power supply (and therefore the transmitter) is held on for 150 milliseconds while a reverse phase "Private-Line" tone is transmitted. This phase shift permits the "Vibrasponder" resonant reed in the listening receiver to be damped rapidly.

e. "Private-Line" Disable

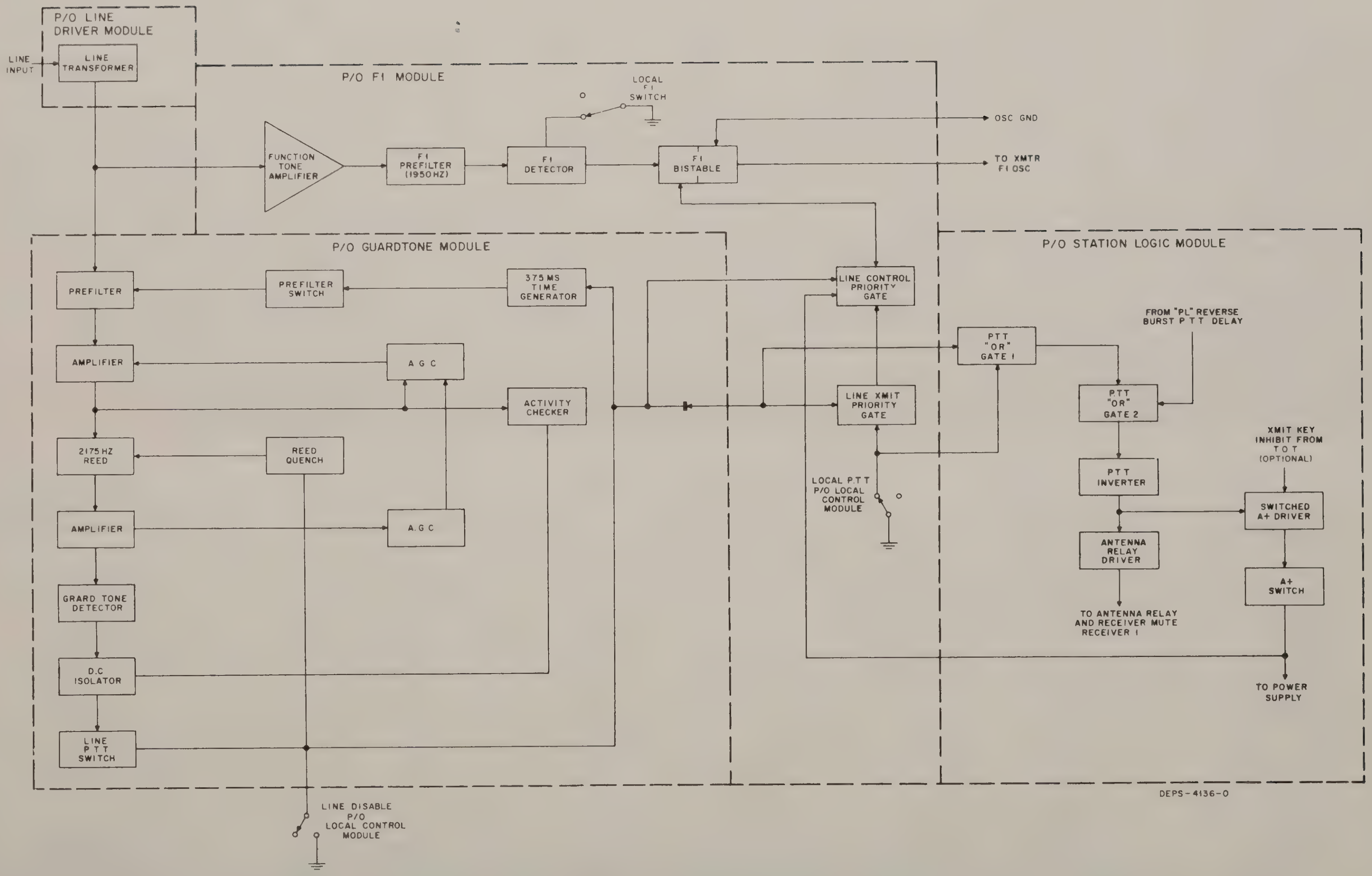
When a 2050-Hz "Private-Line" disable tone burst is applied to the control line, and output is applied to the receiver, reverting it to noise squelch operation. (In a Motorola T1360 Series Remote Control Console the remote function is momentary. Release of the switch on the console reverts the receiver to "Private-Line" operation immediately.) The receiver will remain in the disable mode until the transmitter is keyed or another function is remotely activated.



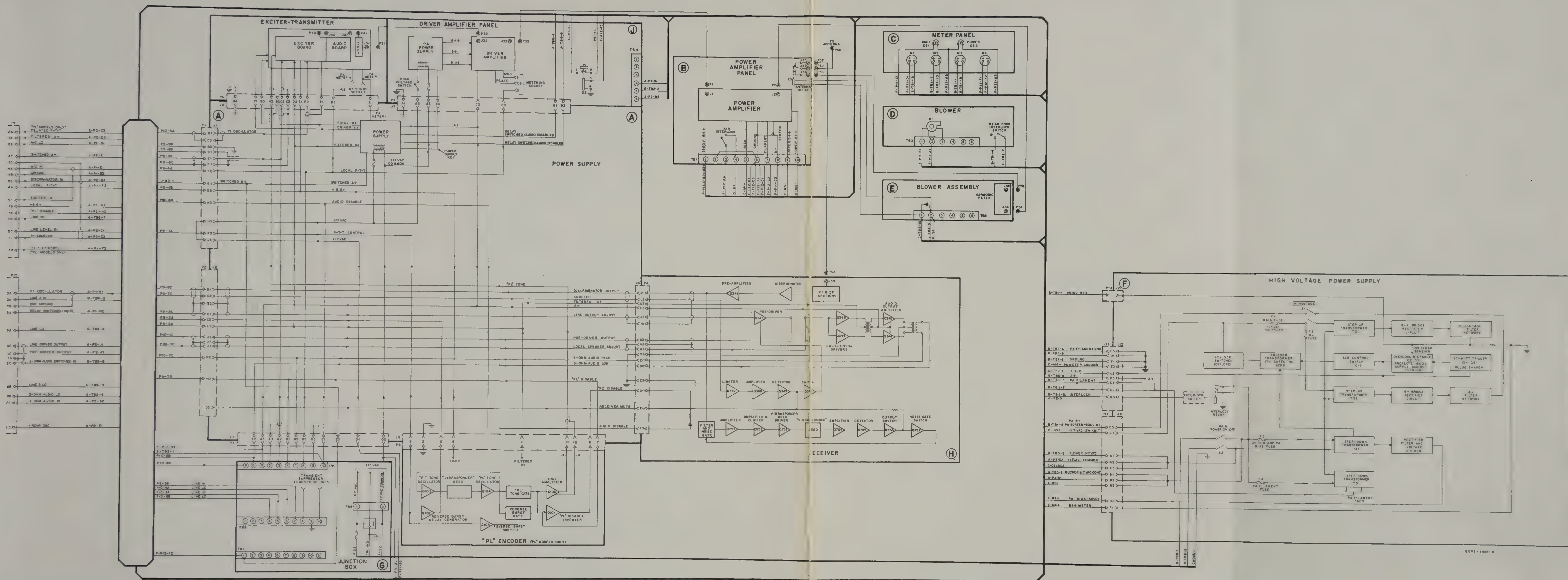
Transmitter Turn-On



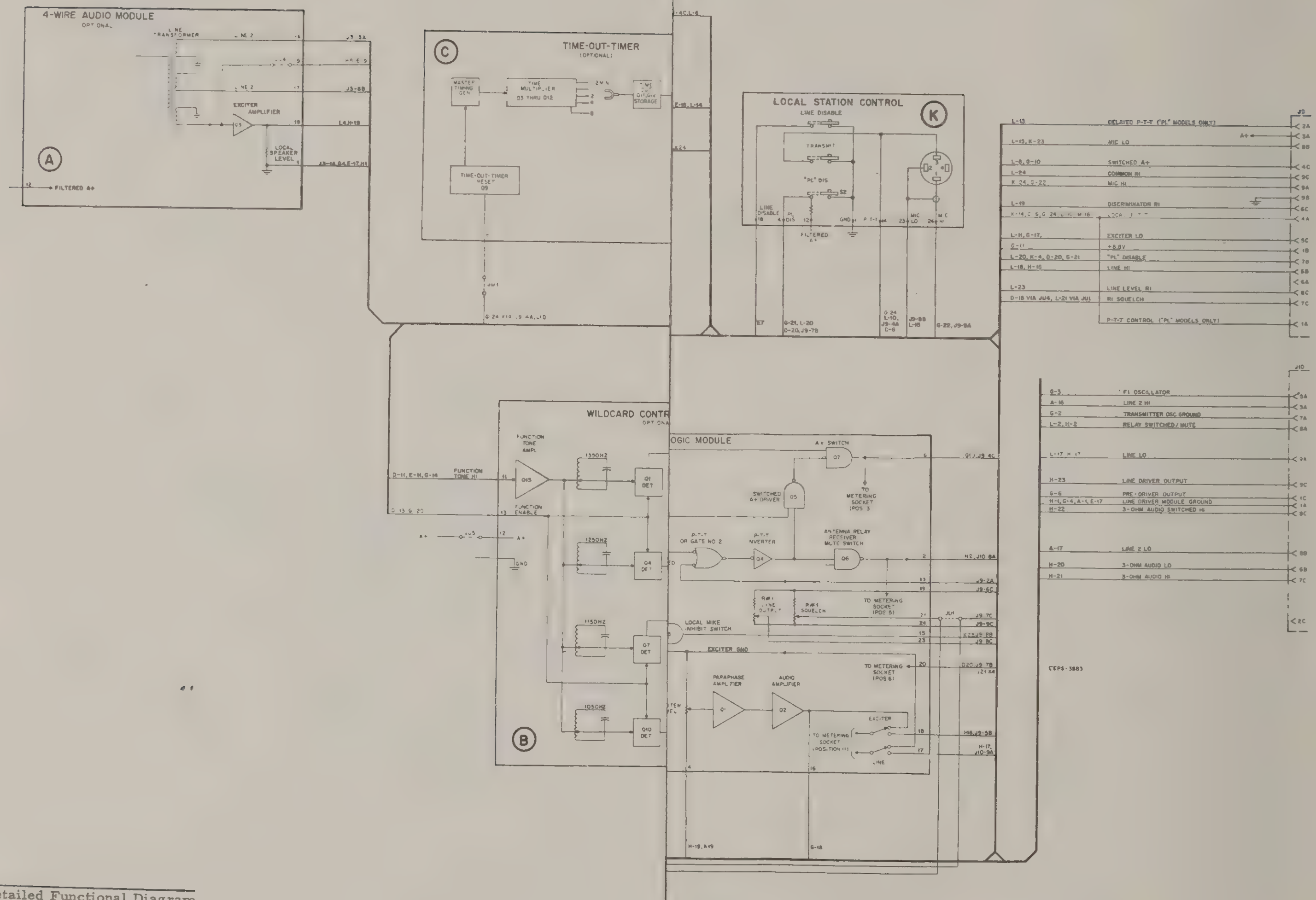
EXCITER-TRANSMITTER
EXCITER BOARD
AUDIO BOARD
DRIVER AMPLIFIER PANEL
PA POWER SUPPLY
DRIVER AMPLIFIER
POWER AMPLIFIER PANEL
POWER AMPLIFIER
POWER SUPPLY
"PL" ENCODER ("PL" MODELS ONLY)
JUNCTION BOX
PRE-AMPLIFIER
DISCRIMINATOR
PRE-DRIVER
LIMITER
AMPLIFIER
DETECTOR
FILTER AND NOISE GATE
AMPLIFIER & CLIPPER



Transmitter Turn-On



Detailed Functional Diagram
Motorola No. EEPS-3983-O
(Sheet 2 of 2)
7/24/70-UP



Detailed Functional Diagram
Motorola No. EEPS-3983-O
(Sheet 1 of 2)
7/24/70-UP

IMPORTANT

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.

2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and local conditions.

3. Frequency, deviation and power of a base station transmitter must be checked before it is placed in service and rechecked every year thereafter.

REMEMBER

The efficiency of the equipment depends upon a good installation.

1. UNPACKING

a. Remove the station from the shipping carton.

b. Remove the keys taped to the front door; unlock and remove both doors (indoor cabinets). Remove all shipping tape from inside the cabinet.

c. Remove the center bolt, the two #14 self-tapping screws and the speed nuts from the shipping bar assembly across the back of the station. Remove and discard the shipping bar.

d. Remove the two flat washers from under the side rails and replace the speed nuts.

e. Replace the two #14 self-tapping screws in the side rails and tighten.

2. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

3. INSTALLATION OF CABINET

a. General

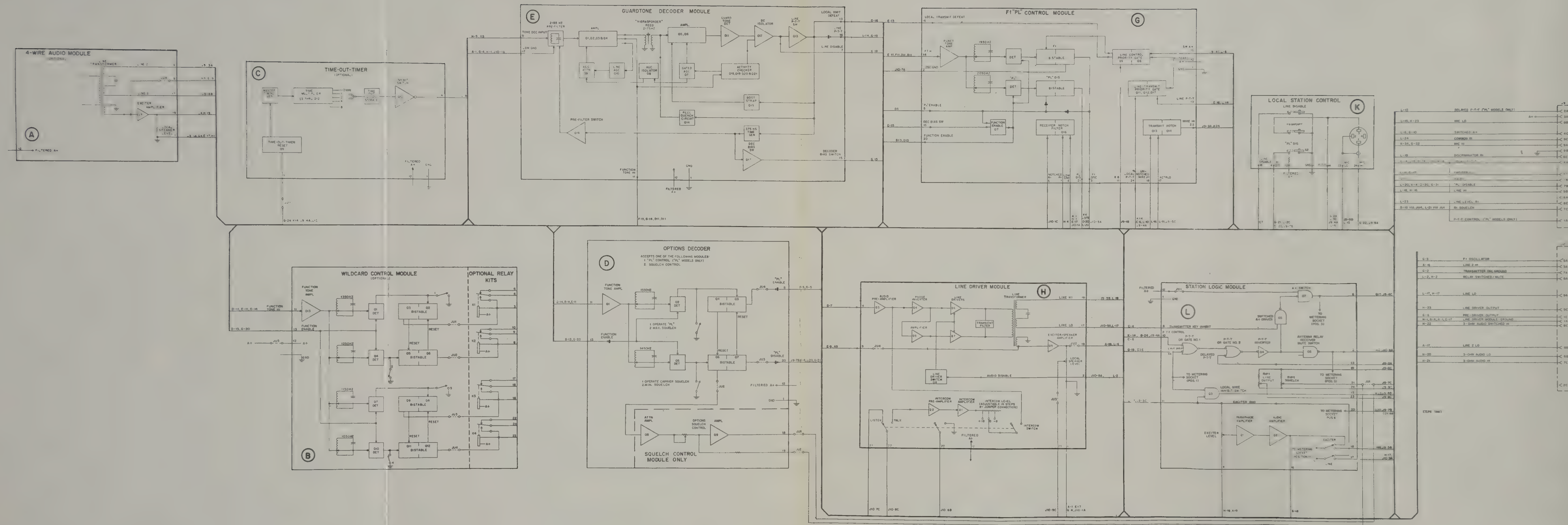
The cabinet should be located on a solid, level surface convenient to the 120-volt ac power source and the transmission line. Allow space for ventilation at the top, front, and rear of the cabinet. The transmission line should be kept as short as possible to minimize line losses.

b. Ventilation

The cabinets have vents which allow outside air to be drawn in through an opening in the rear door and expelled through an opening in the top. The heated air rising in the cabinet causes a natural draft. Therefore, it is essential that the two openings in the cabinet be kept free of obstructions so the air flow will not be restricted.

A blower is provided to cool the final amplifier tubes. A vent at the top of the rear cabinet door allows outside air to be drawn into the cabinet and is routed to the blower via a flexible vent tube.

MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172



Detailed Functional Diagram
Motorola No. EEPS-3983-O
(Sheet 1 of 2)
7/24/70-UP

IMPORTANT

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.

2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and local conditions.

3. Frequency, deviation and power of a base station transmitter must be checked before it is placed in service and rechecked every year thereafter.

REMEMBER

The efficiency of the equipment depends upon a good installation.

1. UNPACKING

a. Remove the station from the shipping carton.

b. Remove the keys taped to the front door; unlock and remove both doors (indoor cabinets). Remove all shipping tape from inside the cabinet.

c. Remove the center bolt, the two #14 self-tapping screws and the speed nuts from the shipping bar assembly across the back of the station. Remove and discard the shipping bar.

d. Remove the two flat washers from under the side rails and replace the speed nuts.

e. Replace the two #14 self-tapping screws in the side rails and tighten.

2. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

3. INSTALLATION OF CABINET

a. General

The cabinet should be located on a solid, level surface convenient to the 120-volt ac power source and the transmission line. Allow space for ventilation at the top, front, and rear of the cabinet. The transmission line should be kept as short as possible to minimize line losses.

b. Ventilation

The cabinets have vents which allow outside air to be drawn in through an opening in the rear door and expelled through an opening in the top. The heated air rising in the cabinet causes a natural draft. Therefore, it is essential that the two openings in the cabinet be kept free of obstructions so the air flow will not be restricted.

A blower is provided to cool the final amplifier tubes. A vent at the top of the rear cabinet door allows outside air to be drawn into the cabinet and is routed to the blower via a flexible vent tube.

c. Antenna Çable

NOTE

Do not substitute connectors or cables for the ones supplied. The supplied material is for use at the high temperatures which may be encountered in the operation of the equipment when located in a high temperature ambient atmosphere.

Install the connector as follows:

(1) Determine the location.

(2) Use a center punch to mark the location.

(3) Drill a 1/4-inch pilot hole.

(4) Use a 3/4-inch hole saw to enlarge the pilot hole.

(5) Using the connector as a template, mark the location of the three mounting holes.

(6) Center punch and drill three holes with a 7/32-inch drill.

(7) Place the gasket (supplied) over the longest stud of the connector.

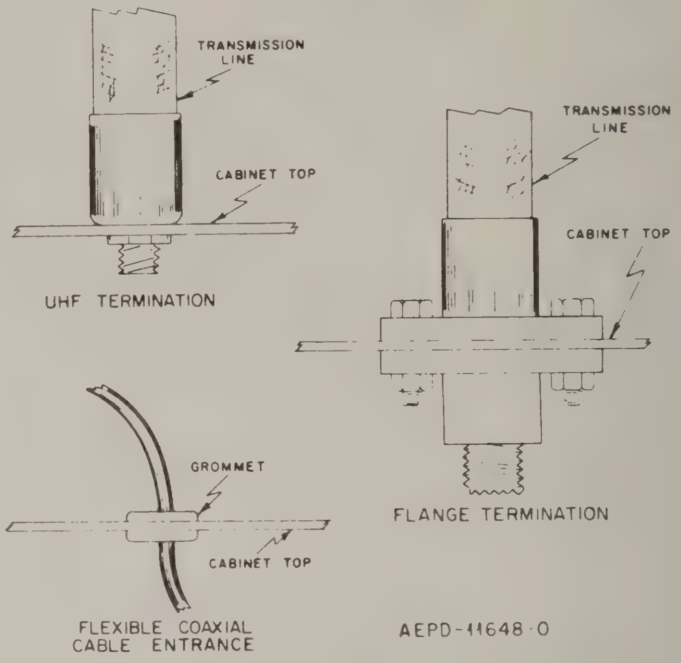
(8) Insert the connector from the outside so the gasket is against the outside cabinet wall.

(9) Secure the connector in place with the three screws, lockwashers and nuts supplied. The nuts should be on the inside of the cabinet.

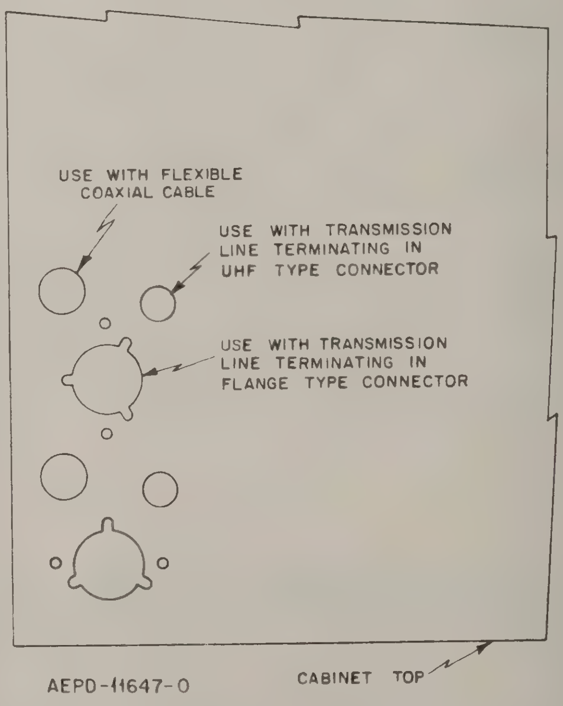
(10) Install the connector(s) and adapter(s) (supplied) to the end of the cable(s) and connect to the proper fitting(s).

d. Power

For rear cable entry, two punch marks are located on the rear panel of the cabinet base. Using these as centers, drill holes in the cabinet using a 3/4-inch hole saw. When viewed from the rear of the cabinet, the left hand hole is intended for the entrance of ac power and the right hand hole is intended for the entrance of control lines. The holes are in line with holes in the junction box so that 1/2-inch thinwall or rigid conduit may be installed through the base and directly to the junction box. Install the conduit, or if conduit is not used, install rubber grommets in the holes to protect the cables. Make power connections as described on the inside of the junction box cover. The green wire is an earth ground to reduce shock hazard. It is not connected to the ac supply, but it may be an extra wire in the cable, conduit, or raceway that houses the current carrying wire from the main service entrance. It may also be connected to the conduit or raceway itself as this is connected to earth ground at the main service entrance. All three wires in the conduit should be #12 TW.



Cabinet Antenna Cable Installation



Cabinet Knockout Detail

For bottom cable entry, power and control cables may be brought in at almost any desired point through the bottom of the cabinet. Refer to the cabinet dimensional detail for specific limitations. Measure and center punch the desired cable entry locations. Using the center punch mark as the center of the holes, drill 3/4-inch holes with a hole saw. Install conduit, or if conduit is not used, install rubber grommets in the holes to protect the cables. Make power connections as described in the previous paragraph.

4. CONNECTIONS

a. Antenna

Installation of the antennas and transmission lines should be made prior to installation of the station. The antennas and transmission lines are not supplied as part of station equipment; therefore, antenna installation instructions are not included herein. Follow the instructions shipped with the antennas for applicable antenna installation procedures.

In its primary application, the station is used for communication with mobile stations. Antennas exhibiting omni-directional characteristics are desirable. However, if the station is located at the outer perimeter of a communications area or if it is to be used for communications with fixed stations, antennas with specific directional characteristics may be more suitable. FCC requirements may also dictate the type of antenna to be used.

The receiver and transmitter outputs can be located at the antenna relay as shown in the intercabling diagram at the end of this section.

b. Control Line

The station can be controlled from a remote point over wire line circuits. Simplex audio is used, meaning that the remote point can send audio to the station or receive audio from the station, but not both at the same time. Therefore, a single audio pair will suffice. The wire line also carries the audio control tones. These are usually carried by the same pair that carries the transmit audio, but a separate pair can be used when necessary.

The control line connecting the base station with the remote control unit shall have a nominal 600-ohm impedance, and no more than 30 dB attenuation. Frequency response between 300 Hz and 3 kHz should be as flat as possible within the limitations of line length and economic considerations.

CHARACTERISTICS OF LEASED TELEPHONE LINES SHOULD BE CHECKED WITH THE COMPANY PROVIDING THE SERVICE PER THE ABOVE REQUIREMENTS.

The control line may be installed prior to installation of the cabinet and terminated near the location chosen for the station. Conduit or two-wire cable can be used from this termination to the junction box via the rear or bottom of the cabinet base. Unless otherwise specified, stations are shipped from the factory for standard two-wire operation. Stations factory equipped with a four-wire audio option (two line driver modules) are shipped with all jumpers installed for receiver line audio output on terminals TB6-4 and TB6-5, and transmit audio input with superimposed tone control on TB6-6 and TB6-7. For additional information and alternate line connections, refer to the audio and control line connections diagram.

As mentioned previously, the lines used to carry audio have an ac impedance of 600 ohms. The amplitude of signals is most conveniently measured in dBm. Zero dBm is equal to 1 milliwatt across 600 ohms. Most audio voltmeters, such as the Motorola Transistorized AC Voltmeter, are calibrated to read directly in dBm when measuring across a 600-ohm impedance. Never use a volt-ohm meter or a multimeter. Connections internally and externally are as shown on the audio and control line connection diagram.

c. AC Power

(1) Power Requirements

All stations require a 25-ampere, 120-volt 50/60 Hz ac power input. This circuit should be installed in accordance with local electrical codes.

The primary ac power line can be installed and terminated near the station site before installing the station cabinet. If the 3-wire line cord (supplied with the station) is used, the ac power line should be terminated with a 3-contact receptacle to accommodate the plug on the power cord.

(2) Power Connections

Connect the three-wire ac line cord to the ac outlet or "turn-on" the power to the

permanent connection. A power on-off switch is provided in the equipment, therefore with power applied, the equipment is in an inoperative condition until the station on-off switch is placed in the "on" position.

The station fuse controls all power to the station except ac power to the outlet in the junction box.

WARNING

If a three-wire grounded primary ac power source is not available, the radio equipment must be grounded separately to prevent electrical shock hazards and provide lightning protection.

d. Optional Driver Amplifier Metering Kit Connections

Connect the speaker 3-ohm audio high (yel) lead to TB9-1 on the metering kit panel terminal strip and the 3-ohm audio low (blk-yel) to TB9-2.

5. PRE-OPERATIONAL ADJUSTMENTS

a. Speech Levels

Most telephone companies limit the maximum signal amplitude which they will allow on their lines. The most common maximum level is +8 vu (volume units), but others allow only 0 vu; check with the telephone company for the maximum level to be used on your lines. Adjust the audio levels to the maximum permissible level which will give the best signal-to-noise ratio.

The vu is the measurement for speech and can be measured only with a vu meter. This meter has special ballistics to control the rise and fall time and the overshoot of speech signal voltages. Since speech signals fluctuate so rapidly, special metering techniques are required. The meter point of a vu meter responds in a series of "kicks" or deflections of varying amplitude. Over a period of time, a majority of peaks will reach approximately the same level. There will be a few very strong peaks which will exceed this level and a few peaks of lower level. These are ignored and the measured speech level equals the majority of the "kicks" or peaks reached. Measurements show that the instantaneous peaks of a speech signal are about 10 dB higher than the vu value (the instantaneous peaks of a 0 vu speech signal will equal the peaks of a sine wave signal of +10 dBm magnitude). Of course, a sine wave signal of +10 dBm would produce a much greater volume because every cycle of the signal goes to peak amplitude.

Adjustment of the audio line levels is very difficult using actual speech signals which fluctuate so greatly. A sine wave signal (1000 Hz continuous tone, for example) is much easier to use for adjustments. However, sine wave signals are measured in dBm and the telphone company specifies the maximum signal level in vu. THERE IS NO CONVERSION FROM VU TO DBM OR VICE VERSA when measuring speech. Speech cannot be measured in dBm or converted into dBm. The dBm is a unit to measure the sine wave power as referenced to 1 milliwatt of power. The power of a speech signal of a particular vu is not defined and is different for different speakers. IT IS POSSIBLE TO CALIBRATE A VU METER BY USING A SINE WAVE SIGNAL ON THE 600-OHM LINE, THEN MEASURING THE SAME SIGNAL IN DBM WITH A VOLTMETER. On a 600-ohm line, a sine wave signal that will produce a 0 vu reading will measure 0 dBm on a voltmeter. This does not mean that 0 vu is equal to 0 dBm. Remember, the peaks of an actual 0 vu speech signal will have instantaneous peaks of +10 dBm amplitude.

We would normally conclude that sine wave signal levels would be adjusted 10 dB higher than the vu level specified for the line. EXPERIMENTAL MEASUREMENTS HAVE PROVEN THAT SINE WAVE SIGNAL LINE LEVELS SHOULD BE 6 DB HIGHER THAN THE VU LEVEL SPECIFIED FOR THE LINE (+8 vu speech level should be adjusted for +14 dBm tone level; 0 vu speech level should be adjusted for +6 dBm tone level).

600-OHM LINE VU, DBM, AND VOLTAGE EQUIVALENCY CHART

If Maximum Speech Level For Line Is	Adjust Tone Line Level for (1 mW ref)	Voltage Equivalent
+14 vu	+20 dBm	7.74 V
+12 vu	+18 dBm	6.15 V
+10 vu	+16 dBm	4.88 V
+ 8 vu	+14 dBm	3.88 V
+ 6 vu	+12 dBm	3.08 V
+ 4 vu	+10 dBm	2.44 V
+ 2 vu	+ 8 dBm	1.94 V
0 vu	+ 6 dBm	1.54 V
- 2 vu	+ 4 dBm	1.22 V
- 4 vu	+ 2 dBm	0.97 V
- 6 vu	0 dBm	0.77 V
- 8 vu	- 2 dBm	0.61 V
-10 vu	- 4 dBm	0.48 V
-12 vu	- 6 dBm	0.38 V
-14 vu	- 8 dBm	0.30 V
-16 vu	-10 dBm	0.24 V
-18 vu	-12 dBm	0.19 V
-20 vu	-14 dBm	0.15 V
-22 vu	-16 dBm	0.12 V
-24 vu	-18 dBm	0.09 V
-26 vu	-20 dBm	0.07 V

b. Control Tone Levels

The control tone levels for the remotely controlled functions are adjusted at the remote control console. No additional adjustment is required. The tone function table lists the control tone frequency and function.

TONE FUNCTION TABLE

TONE FREQUENCY	FUNCTION
2175 Hz	GUARD TONE
2050 Hz	"PL" DISABLE
1950 Hz	F1 SELECTION
1550 Hz	OPERATE "PL" OR OPERATE TIGHT SQUELCH
1450 Hz	OPERATE CARRIER SQUELCH OR OPERATE THRESHOLD SQUELCH
1350 Hz	"WILD CARD" CONTROL
1250 Hz	"WILD CARD" CONTROL
1150 Hz	"WILD CARD" CONTROL
1050 Hz	"WILD CARD" CONTROL

c. Audio Level Settings

Determine the maximum allowable audio level permitted on the lines (use +8 vu for non-regulated lines) and set line audio levels to this amplitude. Refer to the 600-OHM, VU, DBM, AND VOLTAGE EQUIVALENCY CHART for tone levels to be used.

NOTE

The following procedures assume the most common +8 vu speech level (+14 dBm tone level). For other speech levels, use a tone level 6 dB higher than the vu level (for 0 vu use +6 dBm); refer to the equivalency chart. On some lines, tone levels are not permitted to exceed the speech levels, even for short test tones (for example, maximum speech level of 0 vu and maximum tone level of 0 dBm). When such regulations apply, use the special procedures for low level test tone which follows in subparagraph (4).

(1) Transmit Audio Level

(a) Apply a 1000-Hz audio tone at the remote control console which will drive the amplifier into compression. Adjust the output of the remote control console for +14 dBm (or other equivalent) on the transmit audio line as it leaves the remote control console.

(b) Connect an audio voltmeter to pins 1 and 2 of the local microphone receptacle, or TB1-2 and 3.

(c) Adjust the XCTR LEVEL control for the voltage reading stamped on the exciter with +14 dBm (or other equivalent) applied at the remote control console. This setting is 3 dB above the modulator sensitivity of the transmitter and will permit voice peaks to drive the deviation limiting circuit about 6 dB into limiting. This setting gives the best compromise of intelligibility, range, and clarity.

(d) An alternate method for setting the transmitter audio level is to connect a Motorola portable test set with adapter cable to the metering receptacle on the remote control unit. Set the function switch on the test set to the XMTR position and the selector switch to position 11 (AUDIO). Key the transmitter at the remote control console and set the AUDIO switch on the station logic module to the XCTR position. Hold the multiplier switch of the test set in the 0.2 volt position and adjust the XCTR LEVEL control on the station logic module so the test set reading equals the value stamped on the exciter.

(2) Receive Audio Level

(a) Inject a 1000 uV carrier frequency signal at the antenna of the receiver. Modulate the signal with a 1000-Hz tone at full rated deviation (±5 kHz) or have a transmitter in the network send this type of test signal.

(b) Connect an audio voltmeter across the receive audio line at the station.

(c) Adjust the line level control (R#1 LINE OUTPUT) on the station logic module for +14 dBm (or other vu level equivalent).

(d) The audio level may also be measured on a Motorola portable test set connected to the metering receptacle of the remote control unit with an adapter cable. With the function switch in the XMTR position and the selector switch in position 11 (AUDIO), and the AUDIO switch on the station logic module in the LINE position, the test set meter should read 0.39 volt, for lines that are set to +14 dBm.

(e) If the station is not equipped with a local speaker, connect a 3-ohm speaker or load across TB5-6 and 7 in the junction box.

(f) Adjust LOCAL SPEAKER LEVEL for 3 volts across TB5-6 and 7, or if the intercom

feature is used, across TB5-6 and 8. This equipment and setup will be used in the following level adjustments also.

(4) Special Procedure for Low Level Test Tone

NOTE

The following procedure is written for the most common 0 vu speech level and 0 dBm test tone level, but other levels may be used by substituting appropriate levels (levels across the 600-ohm load 6 dB higher than the specified line level).

(a) Terminate the remote control console in a 600-ohm load resistor rather than the line.

(b) Apply a 1000-Hz audio tone at the remote control console which will drive the amplifier into compression.

(c) Connect an audio voltmeter across the 600-ohm load and adjust the line output for +6 dBm.

(d) Reduce the audio input until the meter reads 0 dBm.

(e) Remove the 600-ohm load and reconnect the line. Readjust the line output for 0 dBm across the line. Do not change the tone oscillator level.

(f) Connect the audio voltmeter to pins 1 and 2 of the local microphone at the station and adjust the XCTR LEVEL control for 6 dB less than the value stamped on the exciter.

(g) Disconnect the line at the station and connect a 600-ohm load in its place.

(h) Apply a 1000 uV carrier signal to the receiver antenna terminal from an FM signal generator. Modulate the carrier signal with a 1000-Hz tone at ±5 kHz deviation.

(i) Connect an audio voltmeter across the 600-ohm load and adjust the R#1 LINE OUTPUT control for +6 dBm.

(j) Reduce the deviation until the voltmeter reads 0 dBm.

(k) Remove the 600-ohm load and reconnect the line. Readjust the deviation for 0 dBm as measured across the line.

d. Intercom (Optional Feature)

Audio communications (intercom) between the station and the remote control point are required during adjustment and testing of the station. The remote control unit includes an intercom amplifier circuit but a local speaker is also required. A Motorola Model TLN8204A Metering Kit can be used for the local speaker. Any 3-ohm, 5-watt speaker may be connected to TB5-6 and 8 of the junction box and used for intercom during adjustment and testing of the station and removed when testing is completed.

Line audio from the remote point is heard on the local speaker, and the speaker is used as an intercom microphone when the INTERCOM switch on the line driver module is held in the TALK position.

A jumper on the line driver module (the AMP LEV lead) selects the line level for the audio that is carried from the station to the remote control point. When the line is installed, intercommunications should be established and the jumper connected to the pin which will provide an audio level that most closely approximates the audio level for receive operation. Connect the AMP LEV lead to the +18, 0, or -8 pin and test for satisfactory operation.

e. Time-Out Timer Module

This option supplies a time-out timer to prevent unintentional continuous transmission. The timing jumper on the time-out timer module (connected at the time of installation) can be set for 1/2, 1, 2, 4, or 8 minute operation while the dropout delay generator can be set for 0, 1, 2, 4, or 8 second operation.

The dropout delay generator prevents the transmitter from shutting off during loss or excessive fade of input signal for the length of time preset.

The time-out timer will reset to its preset timed interval each time a new input signal arrives at the radio whether or not the dropout delay generator has shut the transmitter off.

NOTE

A station status chart is located at the back of this manual to record the status of all jumpers at the time of installation. Keep the chart up-to-date as changes occur or modules are added to simplify servicing, modification or replacement of modules.

PRE-OPERATIONAL AND ROUTINE CHECK LIST

UNIT	STEP	CHECK
RECEIVER	1	Compare meter readings with the minimum values in the RECEIVER section of this manual. Realign if necessary.
	2	Measure signal level required for 20 dB quieting.
EXCITER-TRANSMITTER	3	Compare meter readings with minimum values in the EXCITER-TRANSMITTER Section of this manual. Realign if necessary.
POWER AMPLIFIERS	4	Tune and load.
SYSTEM ADJUSTMENTS	5	Measure power output of transmitter.
	6	Measure transmitter frequency and adjust if necessary.
	7	Measure transmitter voice channel for proper deviation. Adjust IDC if necessary.
	8	Measure exciter modulator sensitivity.
	9	Adjust receiver on-frequency.
	10	Measure and adjust audio input to exciter.
	*11	Check for audio tone inputs.
	*12	Measure and adjust audio output from receivers to line.
	*13	Check proper operation of all remotely controlled functions.
	14	Check all accessory adjustments.

*Required only if remote control feature is utilized.

BEFORE LEAVING STATION CHECK THE FOLLOWING

1. All external power switches ON.
2. Station operable from remote location.
3. Local speaker OFF (if applicable).
4. Cabinet doors locked.
5. Vents in rear of cabinet unobstructed.

6. OPERATING INSTRUCTIONS

a. Unattended Operation

Once power is applied and the station is properly adjusted, the station operates entirely unattended.

b. Remote Control

These stations are designed to be controlled from a remote control console over a wire line following the operating instructions for the remote control console.

c. Local Control

WARNING

The transmitter can be keyed by other than local control. Refer to the following table.

The station may be operated locally from the remote control unit for maintenance and testing by the following procedure:

(1) If you do not wish the station to be keyed by remote control while you are operating it, set the LINE DISABLE switch in the direction of the arrow. At the conclusion of local operation, be sure the LINE DISABLE switch is returned to the direction opposite the arrow.

(2) Connect a microphone (Motorola Model TMN6013A or equivalent with 4-prong connector) to the microphone receptacle on the local control panel.

(3) Set the LOCAL SPKR switch to the ON position for stations that are equipped with a local speaker, or connect any 3-ohm 5-watt test speaker to TB5-6 and -7 of the junction box. This speaker

will be used to monitor all received messages. If the speaker will be used for an intercom microphone, connect the speaker to TB5-6 & -8.

(4) The station is now ready to receive incoming signals. Upon reception of audio, adjust the LOCAL SPEAKER LEVEL control for the desired volume. This adjustment is located on the line driver module. For non-wire line repeaters, R1 line output controls the speaker volume.

(5) Before transmitting, monitor for any on-frequency transmissions. If the channel is clear, you may transmit.

(6) Transmit by closing the push-to-talk switch and speaking into the microphone.

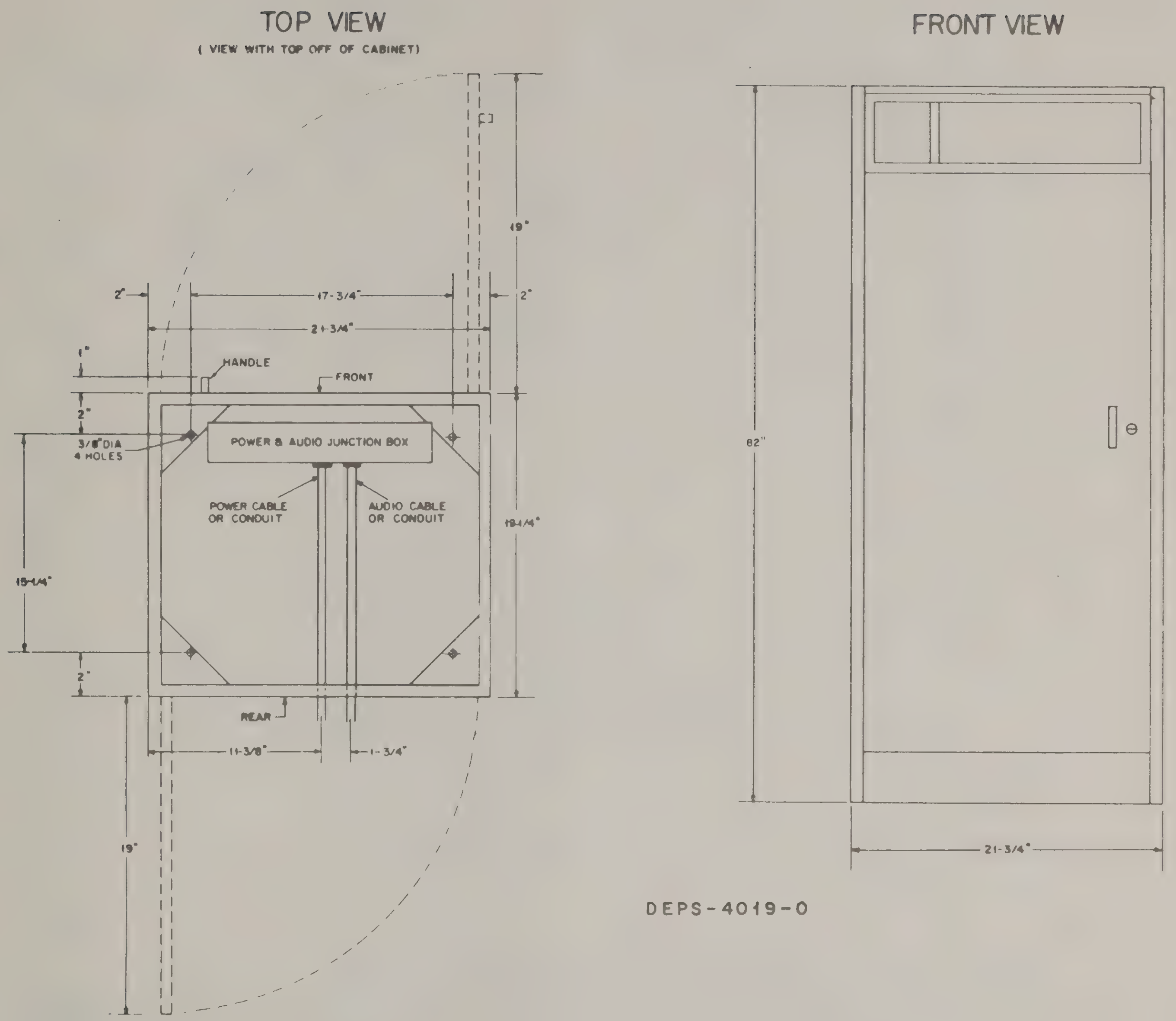
(7) For intercom operation with the remote control point (such as when coordinating adjustments), audio from the remote point is heard on the local speaker. This audio will not be transmitted if the LINE DISABLE switch is in the direction of the arrow or if the remote control console is in the intercom mode of operation.

(8) To talk on the intercom circuit, hold the INTERCOM switch (located on the line driver module) in the TALK position and speak into the local speaker.

(9) At the conclusion of local operation, be sure the LINE DISABLE switch is returned to the direction opposite the arrow. If the station is equipped with a local speaker, set the LOCAL SPKR switch to OFF. If the station is not equipped with a local speaker, disconnect the test speaker.

LOCAL CONTROL PANEL CONTROLS

CONTROL	POSITION	FUNCTIONS POSSIBLE
XMIT	Normal (Not Actuated)	Normal mode of operation
	Actuated (hold to right)	Turns on transmitter with no modulation. Use test microphone connected to local mike receptacle to modulate transmitter.
LINE DISABLE	Normal (Not Actuated)	Transmitter can be operated by a remote control console over control line
	Actuated (hold to right)	Transmitter can be operated by: 1. XMIT switch to key the transmitter 2. Local microphone to key and modulate transmitter

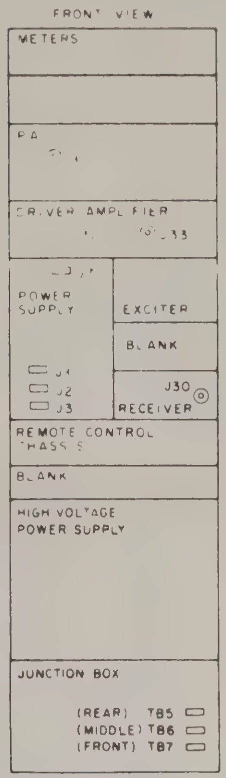


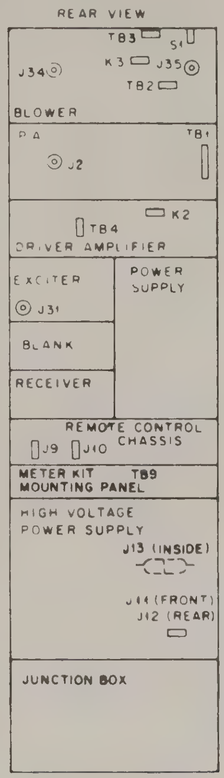
INSTALLATION & OPERATION

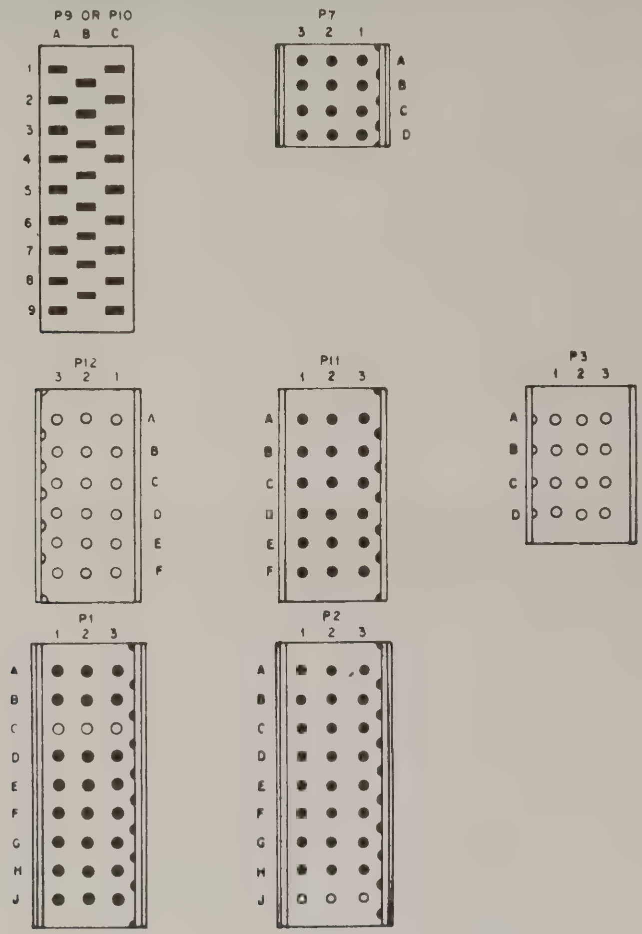
THN6121A Cabinet Dimensional Detail
Motorola No. DEPS-4019-O
4/21/71-UP

NOTE:

1. BASE STATION MODELS ONLY.
2. DIRECTLY CONNECTED TO DRIVER AMPL. MODULE
3. REPEATER STATION MODELS ONLY
4. WHEN OPTIONAL METER KIT IS INSTALLED
   CONNECT YEL-BLK TO TB9-2
   CONNECT YEL TO TB9-1
   (NO CONNECTION MADE TO METER KIT TB1-1 & TB1-2)







PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Tone Remote Control
Base & Repeater Stations
Intercabling Diagram
Motorola No. 63E81012E22-O
4/21/71-UP

INSTALLATION & OPERATION

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

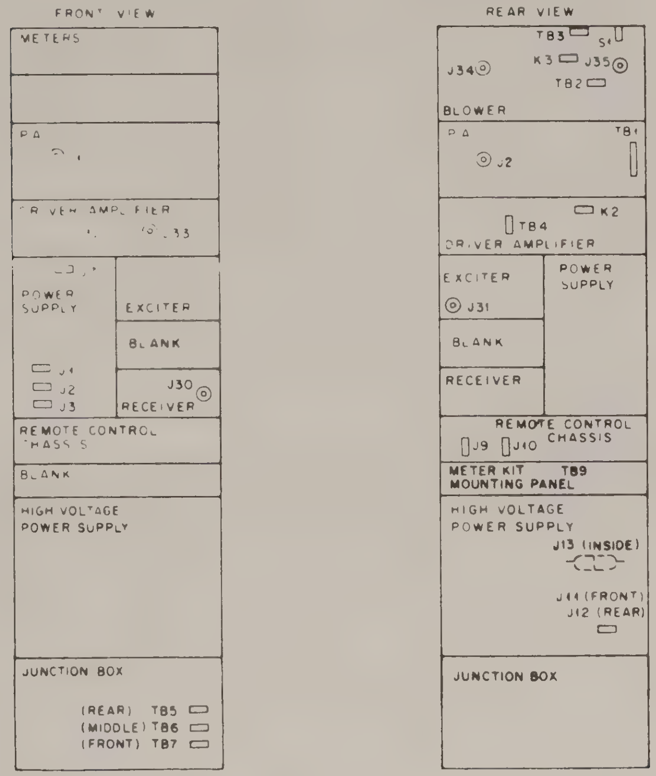
USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

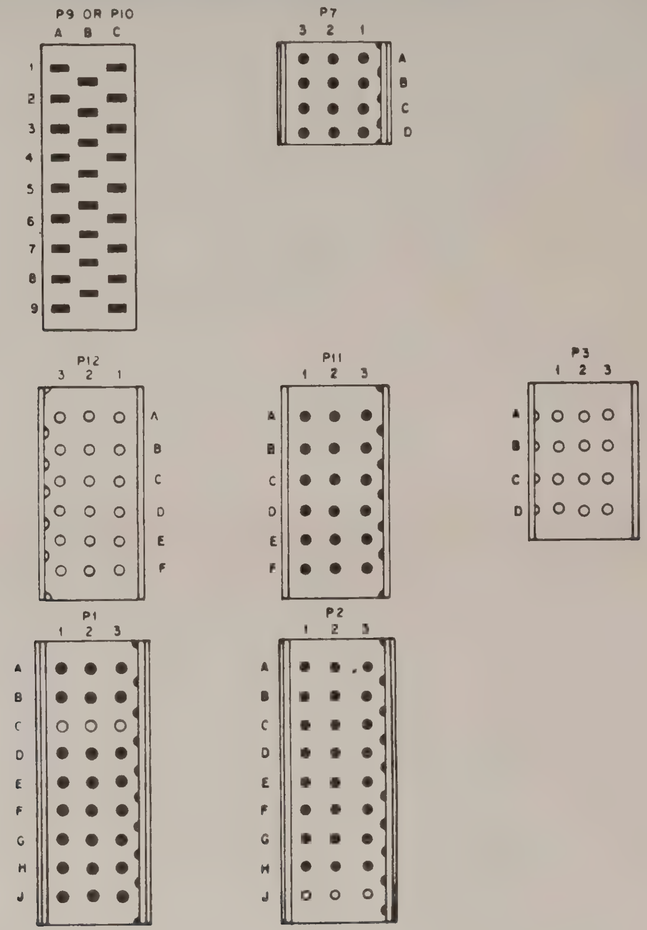
TKN6497A Cable Kit (DC Carrier & "Private-Line" Controlled Base Station) PL-12

		SEMICONDUCTOR DEVICE
		diode:
CR1	40C82466H02	silicon
CR2	40C82466H02	silicon
CR3	40C82466H02	silicon
		ARRESTOR:
E1	80B83029H01	electrical surge (spark gap
E2	80B83029H01	electrical surge (spark gap
		CONNECTOR, plug; coaxia
P1	28B82398E02	male; right angle; type "N"
P2	28A808256	male; type "N"
P33	28K852527	male; type "N"
P34	28A808256	male; type "N"
P35	28K844859	male; right angle; type "N"
P36	28A808256	male; type "N"
P37	28K852527	male; type "N"
		CONNECTOR, plug: phono
P30	28B82331G01	male
		CONNECTOR, plug:
P1		incl. 14C82337A11 BODY (27-hole); 29C82335A01 TE MINAL contact, male; 15B83934A01 SHELL
P2		incl. 14C82337A11 BODY (27-hole); 29C82335A01 TE MINAL contact, male; 15B83934A01 SHELL
P3		incl. 14C83783A05 BODY (12-hole); 29C82335A01 TE MINAL, contact; male; 15C83934A07 SHELL
P9		incl. 14C83833H01 BODY (27-hole); 29C82013H02 T MINAL contact, male; 15B83096H01 SHELL
P10		incl. 14C83833H01 BODY (27-hole); 29C82013H02 TE MINAL contact, male; 15B83096H01 SHELL
P11		incl. 14C82337A07 BODY (18-hole, flanged), 29C82335A01 TERMINAL, contact; male
P12		incl. 14C83783A01 BODY (18-hole); 29C82335A01 TE MINAL, contact, male
		TERMINAL BOARD:
TB9	31K481998	2 screw terminals; coded
		LINE, RF transmission:
W1	30B83182A01	CABLE, RF: coaxial; 43" length req'd
W3	30B83182A01	CABLE, RF: coaxial; 100 length req'd
W4	30B852190	CABLE, RF: coaxial; 20" length req'd
W5	30B852190	CABLE, RF: coaxial; 12" length req'd
		CABLE ASSEMBLY, spec purpose:
W7		miscellaneous leads, lace
	NON-REFERENCED ITEM	
	TLN4503A	MOUNTING PANEL: met

NOTE:

1. BASE STATION MODELS ONLY.
2. DIRECTLY CONNECTED TO DRIVER AMPL. MODULE
3. REPEATER STATION MODELS ONLY.
4. WHEN OPTIONAL METER KIT IS INSTALLED
   CONNECT YEL-BLK TO TB9-2
   CONNECT YEL TO TB9-1
   (NO CONNECTION MADE TO METER KIT TB1-1 & TB1-2)





PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Tone Remote Control
Base & Repeater Stations
Intercabling Diagram
Motorola No. 63E81012E22-O
4/21/71-UP

INSTALLATION & OPERATION

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TKN6497A Cable Kit (DC Carrier & "Private-Line" Controlled Base Station) PL-1252-O

		SEMICONDUCTOR DEVICE, diode:
CR1	40C82466H02	silicon
CR2	40C82466H02	silicon
CR3	40C82466H02	silicon
		ARRESTOR:
E1	80B83029H01	electrical surge (spark gap)
E2	80B83029H01	electrical surge (spark gap)
		CONNECTOR, plug; coaxial:
P1	28B82398E02	male; right angle; type "N"
P2	28A808256	male; type "N"
P33	28K852527	male; type "N"
P34	28A808256	male; type "N"
P35	28K844859	male; right angle; type "N"
P36	28A808256	male; type "N"
P37	28K852527	male; type "N"
		CONNECTOR, plug: phono;
P30	28B82331G01	male
		CONNECTOR, plug:
P1		incl. 14C82337A11 BODY (27-hole); 29C82335A01 TERMINAL contact, male; 15B83934A01 SHELL
P2		incl. 14C82337A11 BODY (27-hole); 29C82335A01 TERMINAL contact, male; 15B83934A01 SHELL
P3		incl. 14C83783A05 BODY (12-hole); 29C82335A01 TERMINAL, contact; male; 15C83934A07 SHELL
P9		incl. 14C83833H01 BODY (27-hole); 29C82013H02 TERMINAL contact, male; 15B83096H01 SHELL
P10		incl. 14C83833H01 BODY (27-hole); 29C82013H02 TERMINAL contact, male; 15B83096H01 SHELL
P11		incl. 14C82337A07 BODY (18-hole, flanged), 29C82335A01 TERMINAL, contact; male
P12		incl. 14C83783A01 BODY (18-hole); 29C82335A01 TERMINAL, contact, male
		TERMINAL BOARD:
TB9	31K481998	2 screw terminals; coded 1 & 2
		LINE, RF transmission:
W1	30B83182A01	CABLE, RF: coaxial; 43" length req'd
W3	30B83182A01	CABLE, RF: coaxial; 100" length req'd
W4	30B852190	CABLE, RF: coaxial; 20" length req'd
W5	30B852190	CABLE, RF: coaxial; 12" length req'd
		CABLE ASSEMBLY, special purpose:
W7		miscellaneous leads, laced
	NON-REFERENCED ITEM	
	TLN4503A	MOUNTING PANEL: meter kit

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TLN4499A Blower PL-1253-O

		CAPACITOR, fixed:
C1	8D83987A03	2 uF ±10%; 600 V dc; oil
		BLOWER & MOTOR:
B1	SP7010062A	Blower and Motor
	NON-REFERENCED ITEM	
	35C82754G01	FILTER SCREEN

TLN4500A Meter Panel PL-1254-O

		LIGHT, indicator: neon;
DS1	65B82296H01	incl. lamp and RED lens
DS2	65B82296H02	incl. lamp and AMBER lens
		AMMETER, DC:
M1	72D84865B03	500 uA
M2	72D84865B05	500 mA
M3	72D84865B05	500 mA
		VOLTMETER, DC:
M4	72D84865B04	200 V; 100 mA
	NON-REFERENCED ITEMS	
	61C84540C01	PANE, glass
	13B83155C01	GRILLE, speaker

TLN4501A Antenna Relay Kit PL-1255-O

		RELAY, antenna:
K3	80D84654C01	12 V; coaxial; spst
		LINE, RF transmission;
W6	30B852190	CABLE, RF: coaxial; 48" length req'd
		CONNECTOR, plug; coaxial:
P39	28A828256	male; type "N"
P50	28A828256	male; type "N"

1V80701B81 Cable Assembly (p/o Driver Amplifier) PL-1256-O

		LINE, RF transmission;
W2	30C82921H01	CABLE, RF: coaxial; 35" length req'd
		CONNECTOR, plug; coaxial;
P31	28B82331G01	male; miniature type
P32	28B82331G01	male; miniature type

TLN4433A Cabinet Accessories PL-1031-O

		FUSE, plug:
F1	65B83099A07	standard screw-base type; 20 A; 125 V
		SWITCH, sensitive:
S1	40B84188A01	door "interlock"; spst

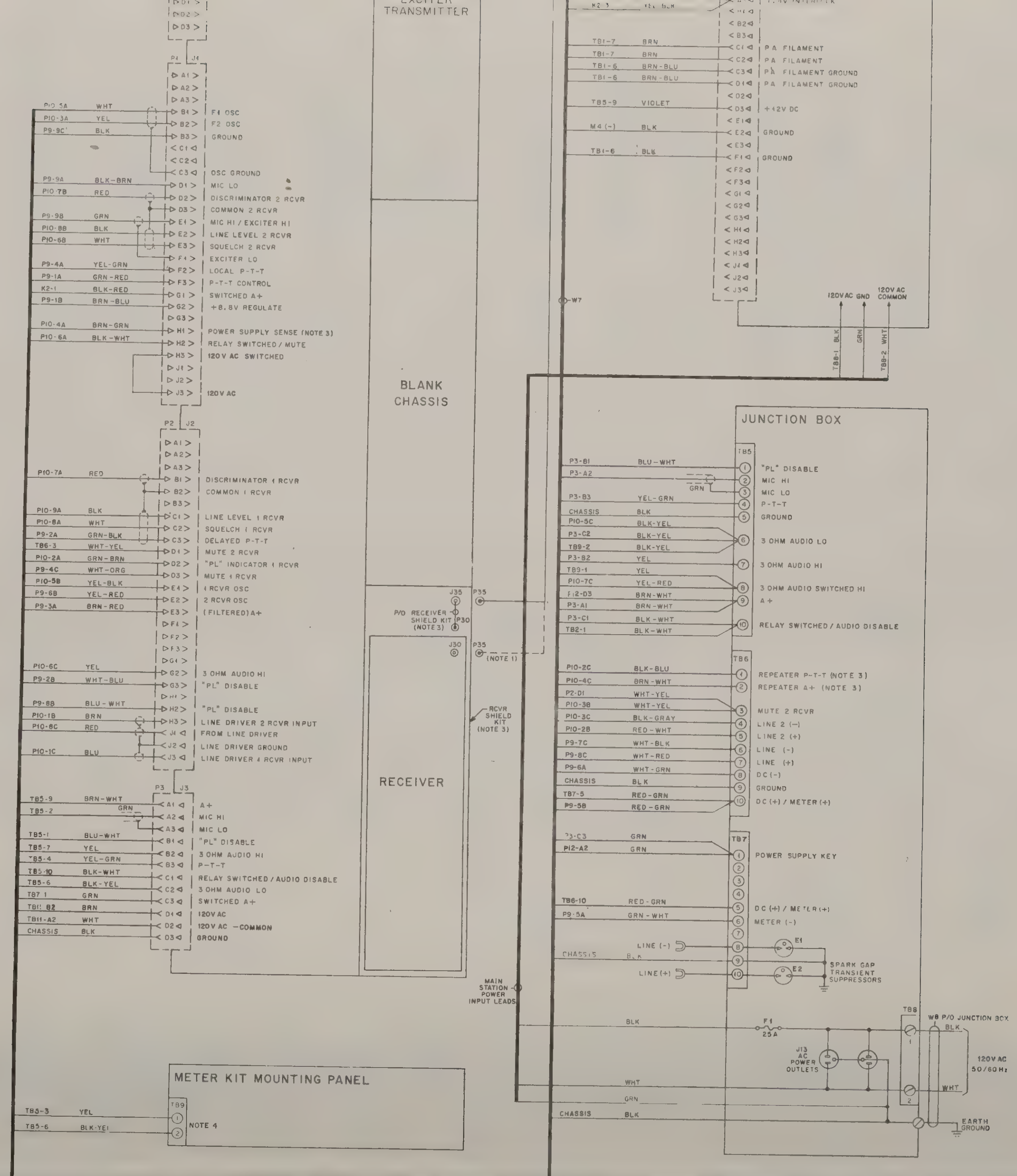
TLN4498AV Junction Box PL-1267-O

		CONNECTOR, receptacle:
J13	9A891865	female dual unit; each section 3-contact
		TERMINAL BOARD:
TB5	31B848187	10 screw terminals
TB6	31B848187	10 screw terminals
TB7	31B848187	10 screw terminals
TB8	31A50378	dual screw terminals
		CABLE ASSEMBLY:
W8	1V80781A84	3-conductor cable and a molded-on 3 cond male plug; length 9 ft.
		FUSEHOLDER:
XF1	9C83122C01	standard screw-base type

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TLN1386A Filter & Panel PL-1258-O

		FILTER,
Z1	TLN6040A	Harmonic Filter
		SEMICONDUCTOR DEVICE, diode:
CR1	40C82466H02	silicon
CR3	40C82466H02	silicon

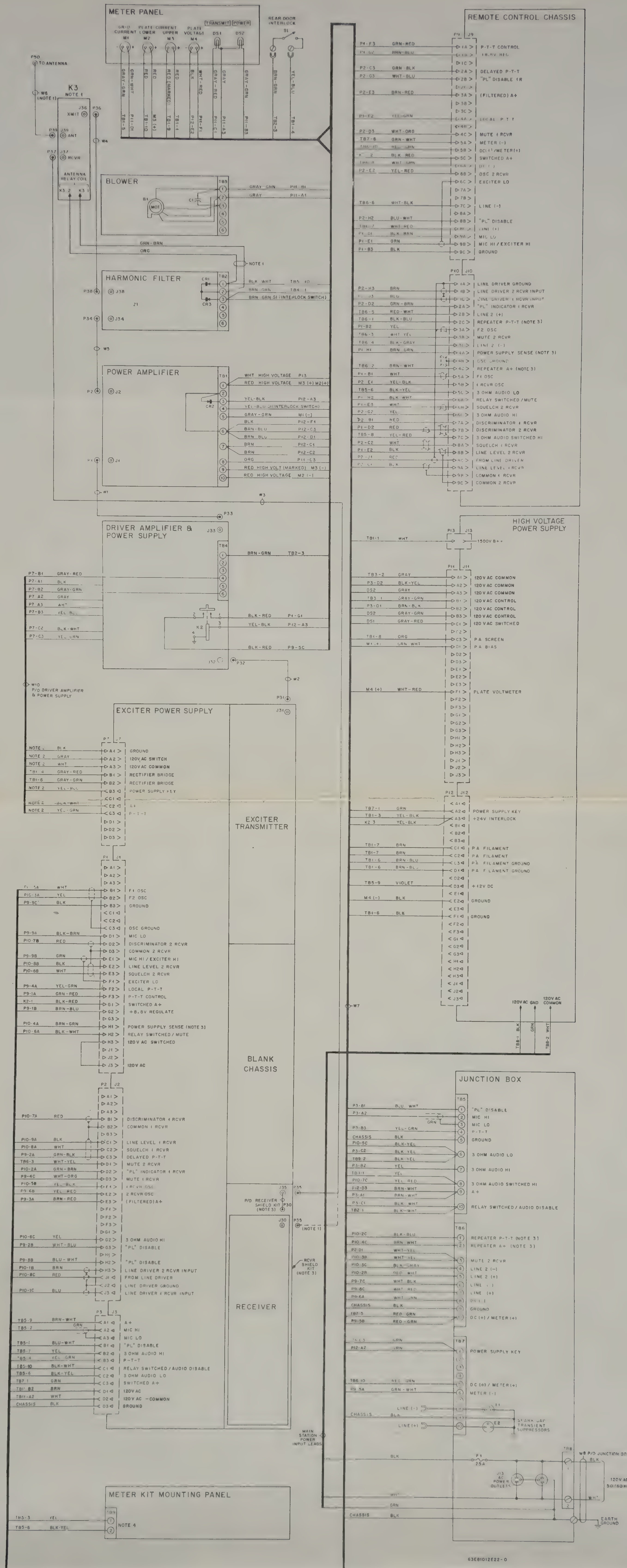


63E81012E22-0

NOTES:

1. SEE PARTS LIST FOR COMPONENT VALUE.
2. REMOVE JUMPER FOR "PRIVATE-LINE" MODELS.
3. CAPACITOR IS DELETED AND REPLACED BY A JUMPER ON SINGLE-FREQUENCY MODELS.
4. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS.
5. REFER TO THE TRANSMITTER AND RECEIVER ALIGNMENT PROCEDURES FOR THEIR CORRESPONDING TRANSMITTER AND RECEIVER CRYSTAL FREQUENCY CALCULATIONS.
6. DO NOT USE SLOW-BLOW FUSE.
7. ALL DC VOLTAGES ARE MEASURED WITH A 20K-OHM-PER-VOLT MULTIMETER. SUPPLY VOLTAGE DURING TRANSMIT: 13.8 V; SUPPLY VOLTAGE DURING RECEIVE: 13.8 V.
   USQ = RECEIVER UNSQUELCHED
   FSQ = RECEIVER FULLY SQUELCHED
   A. RECEIVER AND TRANSMITTER VOLTAGES ARE REFERENCED TO RADIO CHASSIS.
   B. WHEN MEASURING TRANSMITTER VOLTAGES, USE A 33 uH CHOKE IN SERIES WITH THE MULTIMETER PROBE TO BLOCK RF VOLTAGES.
   C. DENOTES VEHICLE GROUND (NOT CHASSIS GROUND).
   D. ⏚ DENOTES RADIO CHASSIS GROUND.
   E. ALL AC AND DC VOLTAGES SHOWN ARE TYPICAL VALUES.
8. TRANSISTOR BASE DETAILS ARE SHOWN ON CORRESPONDING CIRCUIT BOARD DETAIL.
9. BOLD NUMBERS INDICATE CORRESPONDING TIE POINTS.

EPS-4101-O



METER PANEL
REMOTE CONTROL CHASSIS
K3
BLOWER
HARMONIC FILTER
POWER AMPLIFIER
HIGH VOLTAGE POWER SUPPLY
DRIVER AMPLIFIER & POWER SUPPLY
EXCITER POWER SUPPLY
EXCITER TRANSMITTER
BLANK CHASSIS
JUNCTION BOX
RECEIVER
METER KIT MOUNTING PANEL
63E81012E22-D

NOTES:

1. SEE PARTS LIST FOR COMPONENT VALUE.
2. REMOVE JUMPER FOR "PRIVATE-LINE" MODELS.
3. CAPACITOR IS DELETED AND REPLACED BY A JUMPER ON SINGLE-FREQUENCY MODELS.
4. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS.
5. REFER TO THE TRANSMITTER AND RECEIVER ALIGNMENT PROCEDURES FOR THEIR CORRESPONDING TRANSMITTER AND RECEIVER CRYSTAL FREQUENCY CALCULATIONS.
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   USQ = RECEIVER UNSQUELCHED
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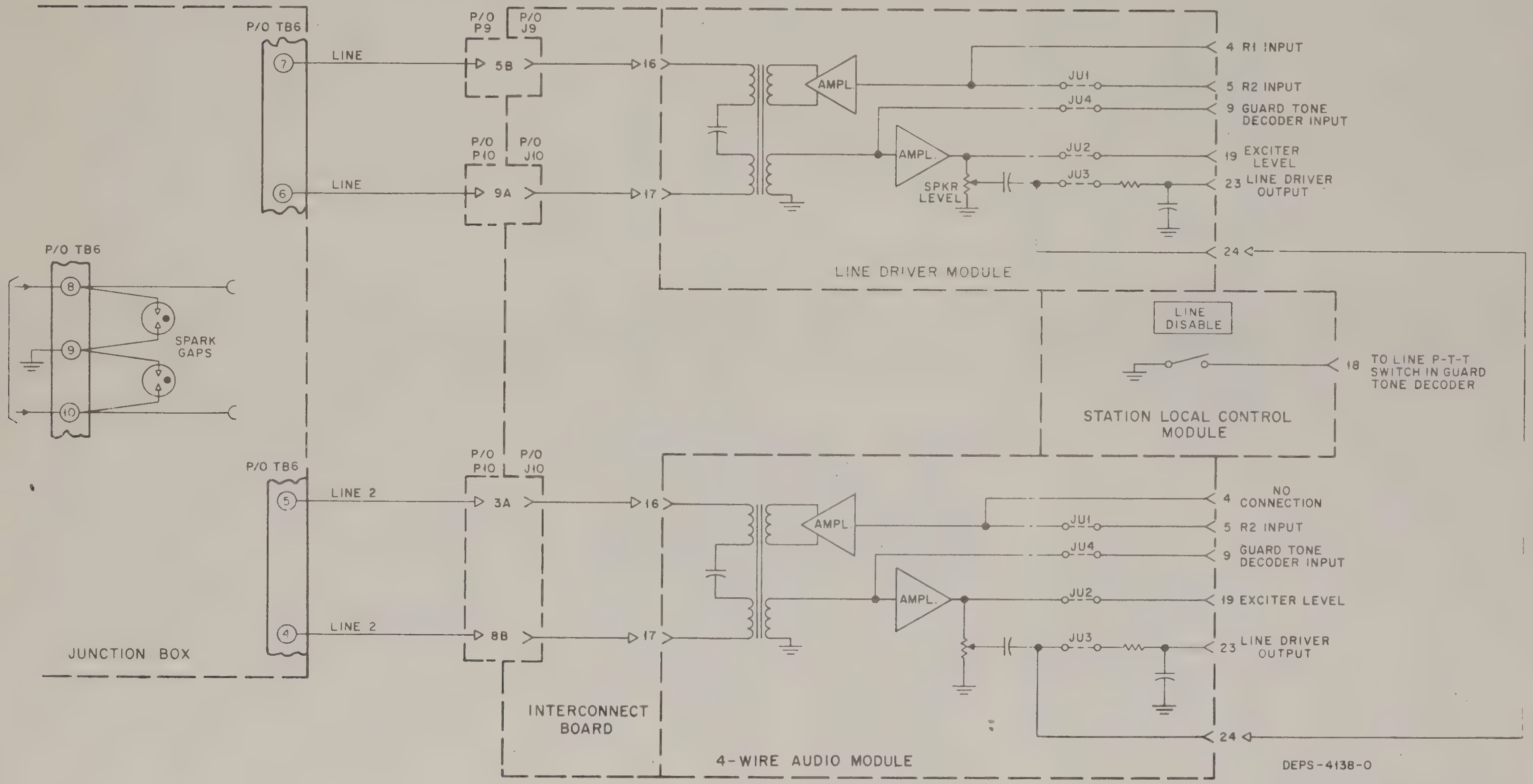
   A. RECEIVER AND TRANSMITTER VOLTAGES ARE REFERENCED TO RADIO CHASSIS.
   B. WHEN MEASURING TRANSMITTER VOLTAGES, USE A 33 uH CHOKE IN SERIES WITH THE MULTIMETER PROBE TO BLOCK RF VOLTAGES.
   C. DENOTES VEHICLE GROUND (NOT CHASSIS GROUND).
   D. DENOTES RADIO CHASSIS GROUND.
   E. ALL AC AND DC VOLTAGES SHOWN ARE TYPICAL VALUES.
8. TRANSISTOR BASE DETAILS ARE SHOWN ON CORRESPONDING CIRCUIT BOARD DETAIL.
9. BOLD NUMBERS INDICATE CORRESPONDING TIE POINTS.

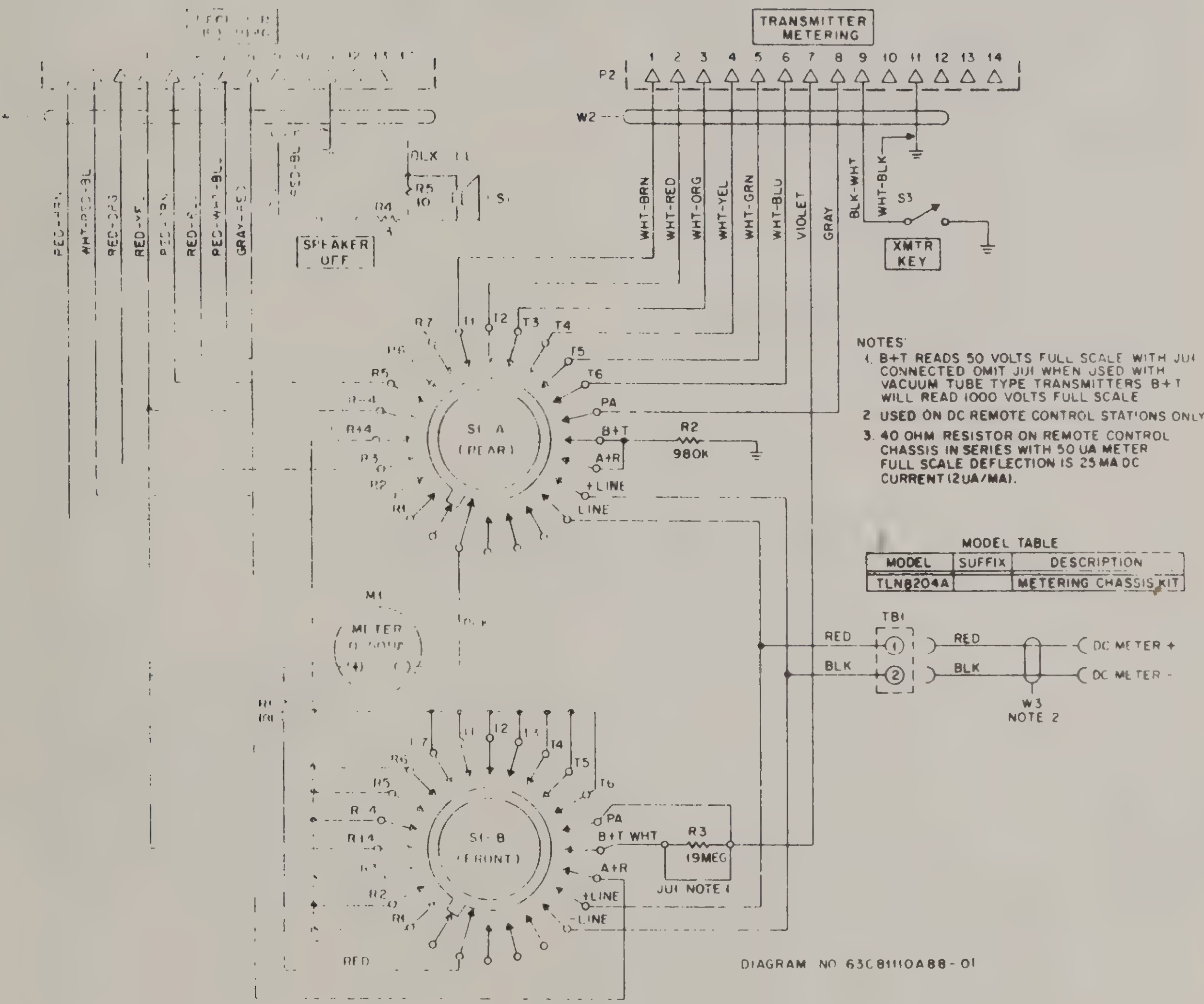
EPS-4101-O



Audio and Control Line
Connections Diagram
Motorola No. PEPS-4141-O
4/21/71-UP

METERING KIT

MODEL TLN8204A



NOTES:
1. B+T READS 50 VOLTS FULL SCALE WITH JU1 CONNECTED OMIT JU1 WHEN USED WITH VACUUM TUBE TYPE TRANSMITTERS B+T WILL READ 1000 VOLTS FULL SCALE
2. USED ON DC REMOTE CONTROL STATIONS ONLY
3. 40 OHM RESISTOR ON REMOTE CONTROL CHASSIS IN SERIES WITH 50 UA METER FULL SCALE DEFLECTION IS 25 MA DC CURRENT (2UA/MA).

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
TLN8204A		METERING CHASSIS KIT

DIAGRAM NO 63C81110A88-01

PARTS LIST ON BACK

PARTS LIST for Diagram 63C81110A88-O1

31N8204A Metering Chassis

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LOUDSPEAKER, permanent magnet:
LS1	50B893245	2-1/2"; square, 3.2 ohms impedance; weatherproof
	or 50K801757	2-1/2" square; 3.2 ohms imp.
		AMMETER, DC:
M1	72D83120C01	0-50 ua; res. 1820 ohms ±10%
		CONNECTOR, plug:
P1, 2	28B863663	male; 12 contact; does not incl. 15A82798H01 SHELL, connector
		RESISTOR, fixed.
R1	6K892470	18K ±1%; 1/2 w
R2	6K811974	980K ±2%; 1/2 w
R3	6D82475B64	19 meg ±1%, 1/2 w
R4	17D82177B04	5 ±10%; 5 w
R5	6R488022	10 ±10%; 1 w
		SWITCH,
S1	40C83158C01	rotary: 2 section; c/o:
S1A		24 position, non-shorting
S1B		24 position; non-shorting
S2	40A11589	slide: spdt
S3	40A840806	slide: spdt (one position momentary)
		TERMINAL BOARD:
TB1	31A863823	2 screw terminals
		CABLE ASSEMBLY, special purpose:
W1	1V80755A64	incl. P1 & miscellaneous leads
W2	1V80755A65	incl. P2 & miscellaneous leads
W3	1V80755A85	CABLE ASSEMBLY, special purpose

RF PACKAGE

FOR

BASE AND REPEATER RADIOS

450-470 MHz 250/275 W RF POWER

CONTENTS OF PACKAGE

MODEL TABLE

MODEL	FREQUENCY RANGE	APPLICATION
TTE1133AA TTE1134AA	450-460 MHz 460-470 MHz	Standard
TTE1313AA TTE1314AA		With Optional Transmitter Shield

1. DESCRIPTION

The exciter-transmitter is a completely solid-state unit. It provides a phase-modulated, crystal-controlled rf output in the 450 to 470 MHz range with a nominal power output of 12 watts. The Transmitter Block Diagram (Figure 1) shows the stage-by-stage signal flow and operating frequencies.

2. CIRCUIT DESCRIPTION

a. <u>1st Audio Amplifier, Clipper, and 2nd Audio/IDC Stage</u>

The audio input from the line transformer or microphone amplifier enters a pre-emphasis network before being coupled to the audio amplifiers. The output from 1st audio amplifier Q181 is fed through a coupling capacitor to the clipper, where audio peaks in excess of a specific level are removed from the signal. The output of the clipper passes through a "splatter filter" before being applied to the 2nd Audio Amplifier and IDC Circuit (Q182).

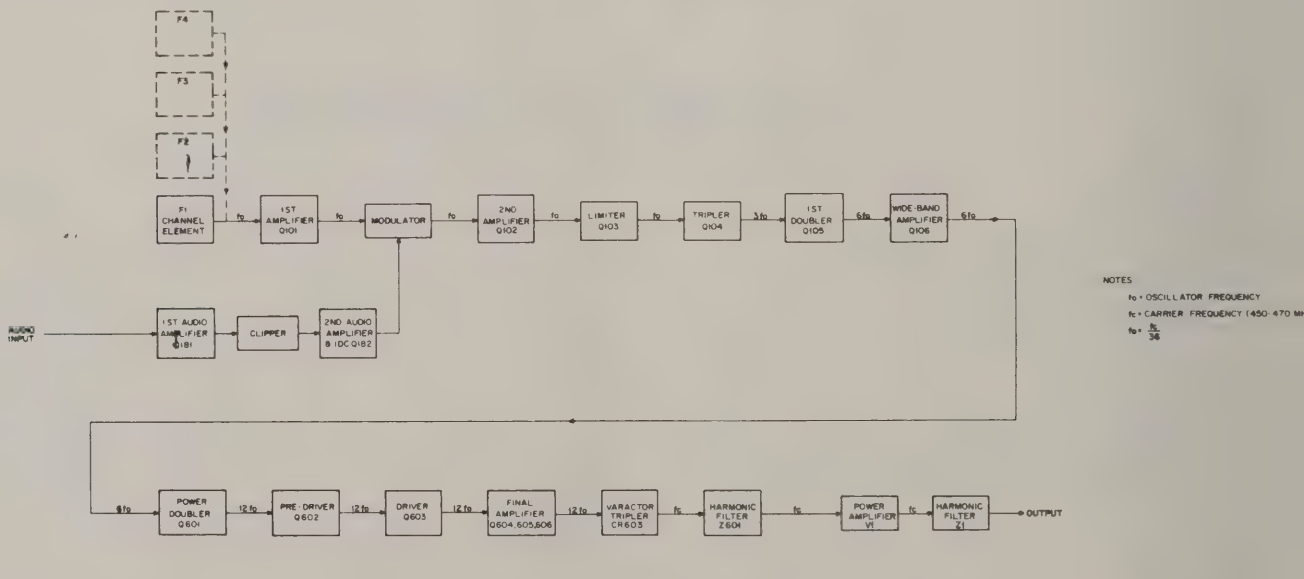


Figure 1.
Transmitter Block Diagram

The clipper/filter limits the slope (steepness) of the audio signals which pass through it, as illustrated in Figure 2. The "shaped" audio signal is amplified by emitter-follower Q182 whose output is adjusted by "instantaneous deviation control" (IDC) potentiometer R119. The IDC control, the clipper stage, the pre-emphasis and de-emphasis circuits, and the two audio amplifiers comprise a "deviation limiting circuit".

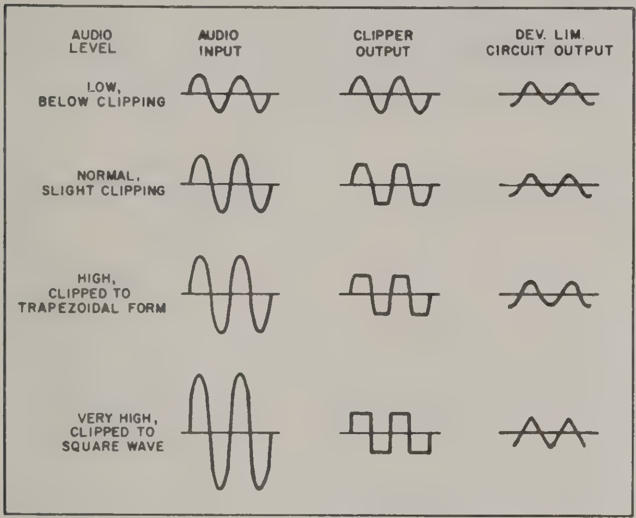


Figure 2.
Deviation Limiting Circuit Waveforms

b. Oscillator (Channel Element)

The plug-in channel element consists of a transistorized oscillator circuit and a crystal. The crystal is unheated and the oscillator circuit is compensated for frequency stability over the entire temperature range. For multi-frequency operation, additional channel elements are used. A variable "warp" capacitor is mounted in the base of each channel element, and is accessible through a hole in the exciter circuit board. Each oscillator operates on a specific frequency in the 12.5 to 13.055 MHz range.

c. First RF Amplifier

First Amplifier Stage Q101 provides a constant load for the oscillator and amplifies the channel element output to the proper rf level for the modulator. The series-resonant network in the emitter circuit of this amplifier offers negligible impedance over the range of crystal frequencies from 12.5 to 13.055 MHz.

d. Modulator

The audio output of the deviation limiting circuit is applied to the modulator which phase-modulates the output of the 1st amplifier. The tuning elements of the modulator tank circuits are varactors (CR101, CR102 and CR104). The capacitance of these special back-biased diodes is a function of the potential across them. The audio signal applied to the varactors changes the potential at an audio rate and consequently varies the capacitance in the modulator tank circuit. This changes the phase angle of the rf signal, producing modulation.

e. Multipliers and Amplifiers

From the modulator, the rf signal is amplified (Q102), limited (Q103), and applied to Q104 where its frequency is tripled. It is then applied to Q105 where the rf frequency is doubled, and then amplified by wide-band amplifier Q106. All of the rf circuitry up to this point is contained on the exciter board. All stages are conventional common-emitter circuits, with the exception of the 2nd amplifier (Q102) which is a field effect transistor (FET). The rf output of the exciter board is at a frequency of 75 to 78.33 MHz, with a nominal power output of 400 milliwatts. This rf output (from Q106) is applied as the input signal to the doubler-driver circuit board.

f. Doubler-Driver Board

The doubler-driver board contains three stages: Power Doubler Q601, Pre-Driver Q602 and Driver Q603. The input rf signal is applied to the Power Doubler where it is amplified and doubled in frequency. The signal is then amplified in the pre-driver and driver stages to produce an rf signal of sufficient power to drive the final amplifier. The pre-driver and driver stages are protected by the driver current limiter in the main power supply.

g. Final Amplifier Board

The final rf amplifier is comprised of three power transistors (Q604, Q605 and Q606) connected in parallel. The output is LC coupled through C107 and L625 to the varactor tripler stage. The final amplifier transistors are also protected by the final current limiter located in the main power supply.

h. Varactor Tripler

The varactor tripler multiplies the signal to the desired carrier frequency in the 450-470 MHz range. The circuitry associated with the tripler and the varactor diode (CR603) is contained in the varactor housing. The output of the varactor tripler is then passed through a bandpass harmonic filter (Z601). Nominal rf power output at this

point is 12 watts. This signal is applied via a short length of coaxial cable to the power amplifier.

3. TROUBLESHOOTING

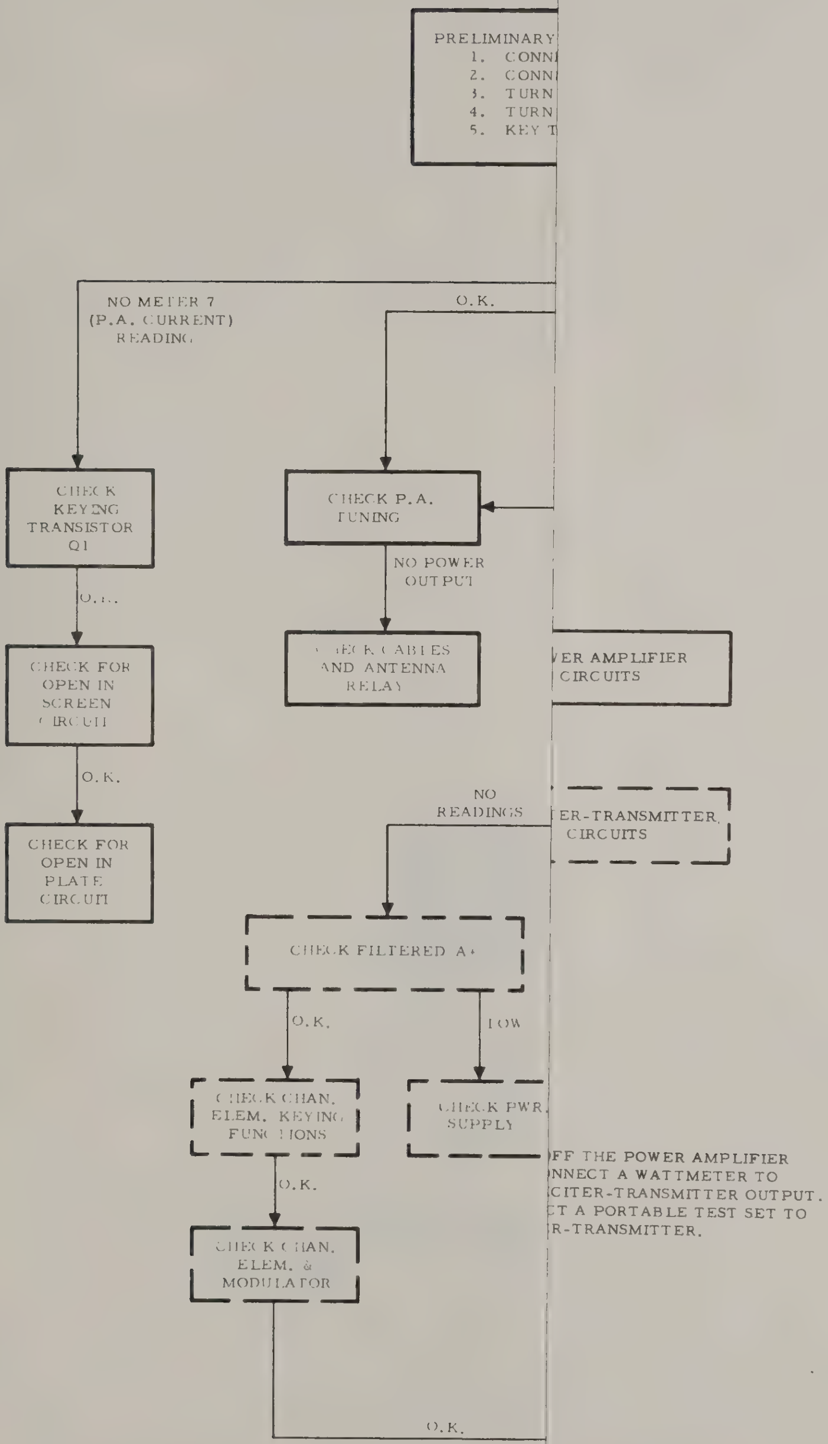
a. Alignment

Many transmitter troubles are due to incorrect alignment (tune-up and loading). Transmitter alignment therefore becomes a logical part of transmitter troubleshooting. A complete transmitter alignment is also a necessary final step after transmitter repairs have been completed to assure that the transmitter is again being correctly loaded at the output frequencies.

In the course of troubleshooting the transmitter, it may be necessary to disturb alignment adjustments. It is important that the transmitter be completely tuned after such procedures. Peak tuning of individual stages is not adequate. The entire procedure must be followed to obtain correct alignment of the transmitter.

b. Fault Location

A general procedure for localizing faults is given in "flow chart" form in the Transmitter Troubleshooting Chart.



PRELIMINARY
1. CONN
2. CONN
3. TURN
4. TURN
5. KEY T
NO METER 7 (P.A. CURRENT) READING
O.K.
CHECK KEYING TRANSISTOR Q1
CHECK P.A. TUNING
NO POWER OUTPUT
O.K.
CHECK FOR OPEN IN SCREEN CIRCUIT
CHECK CABLES AND ANTENNA RELAY
ER AMPLIFIER CIRCUITS
O.K.
CHECK FOR OPEN IN PLATE CIRCUIT
NO READINGS
ER-TRANSMITTER CIRCUITS
CHECK FILTERED A+
O.K.
LOW
CHECK CHAN. ELEM. KEYING FUNCTIONS
CHECK PWR. SUPPLY
FF THE POWER AMPLIFIER
NNECT A WATTMETER TO
CITER-TRANSMITTER OUTPUT.
CT A PORTABLE TEST SET TO
R-TRANSMITTER.
O.K.
CHECK CHAN. ELEM. & MODULATOR
O.K.

point is 12 watts. This signal is applied via a short length of coaxial cable to the power amplifier.

3. TROUBLESHOOTING

a. Alignment

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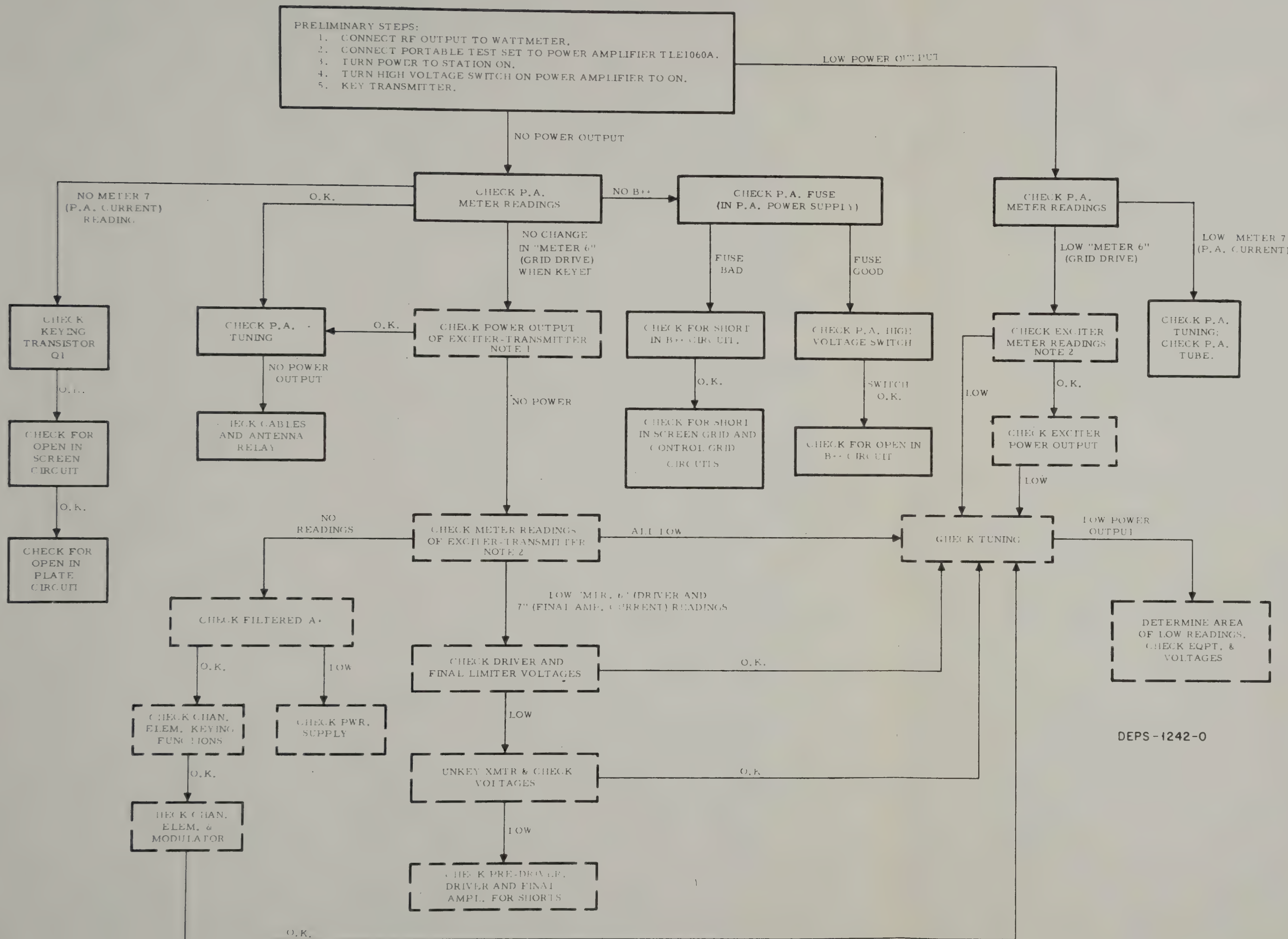
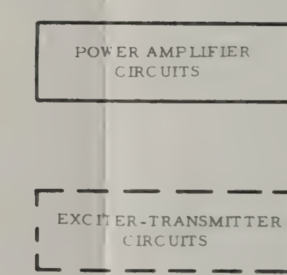
b. Fault Location

A general procedure for localizing faults is given in "flow chart" form in the Transmitter Troubleshooting Chart.

TRANSMITTER TROUBLESHOOTING CHART



KEY:



DEPS-1242-0

NOTES:

1. TURN OFF THE POWER AMPLIFIER AND CONNECT A WATTMETER TO THE EXCITER-TRANSMITTER OUTPUT.
2. CONNECT A PORTABLE TEST SET TO EXCITER-TRANSMITTER.

4. SERVICE AIDS

a. General

The following paragraphs describe proper methods and procedures for servicing the exciter-transmitter chassis. Observe standard servicing practices, such as tagging leads and identification of connecting points. Do not remove any transistor until it has been definitely established that it is damaged or causing a malfunction.

To gain access to the exciter board, remove the front exciter board shield. Removal of the rear shield permits access to the component side of the exciter board, the doubler-driver board, and the final amplifier board. The varactor tripler is accessible after removal of the rear shield and varactor cover. Refer to the Exciter-Transmitter Parts Location Detail for locations of the printed circuit boards and other significant parts in the exciter-transmitter.

b. Audio Board Removal

If the audio board is to be removed, the rear shield must be removed first. Remove the F1 channel element. Then slide the two clips on the top corners of the board to the outside. Pull straight out to remove the board.

c. Power Doubler, Pre-Driver and Driver Transistor Removal

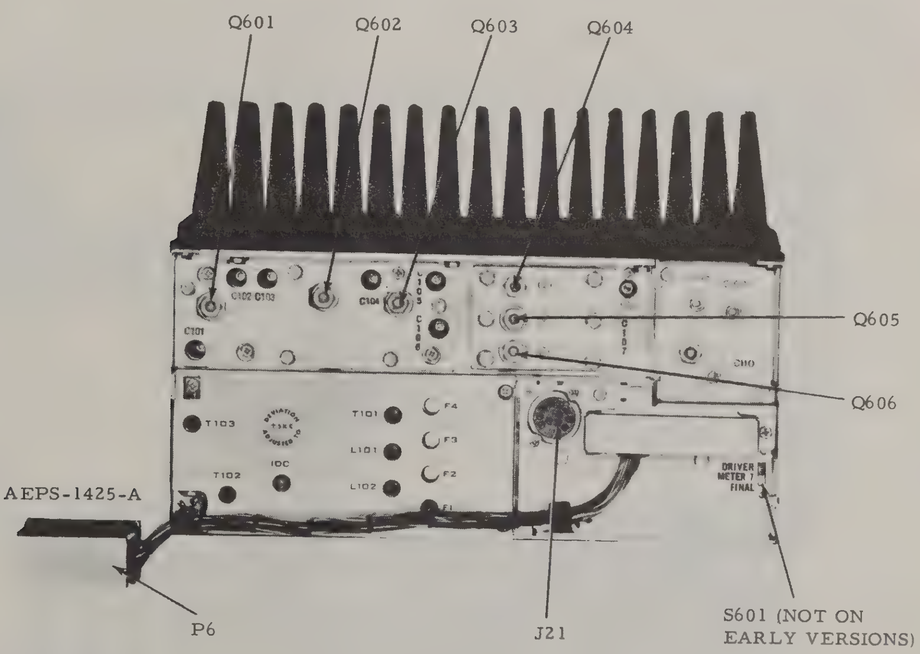
The power doubler, pre-driver or driver transistors (Q601, Q602 or Q603) are removed by the same procedure due to a common heat sink. The rear shield must be removed first and then the heat sink on the front of the chassis. After removal of the heat sink, any of the transistors can be unsoldered and removed from the front. When replacing these transistors, secure the emitter stud to the heat sink and secure the heat sink to the chassis before soldering any of the transistor leads to the circuit board.

d. Final Amplifier Transistor Removal

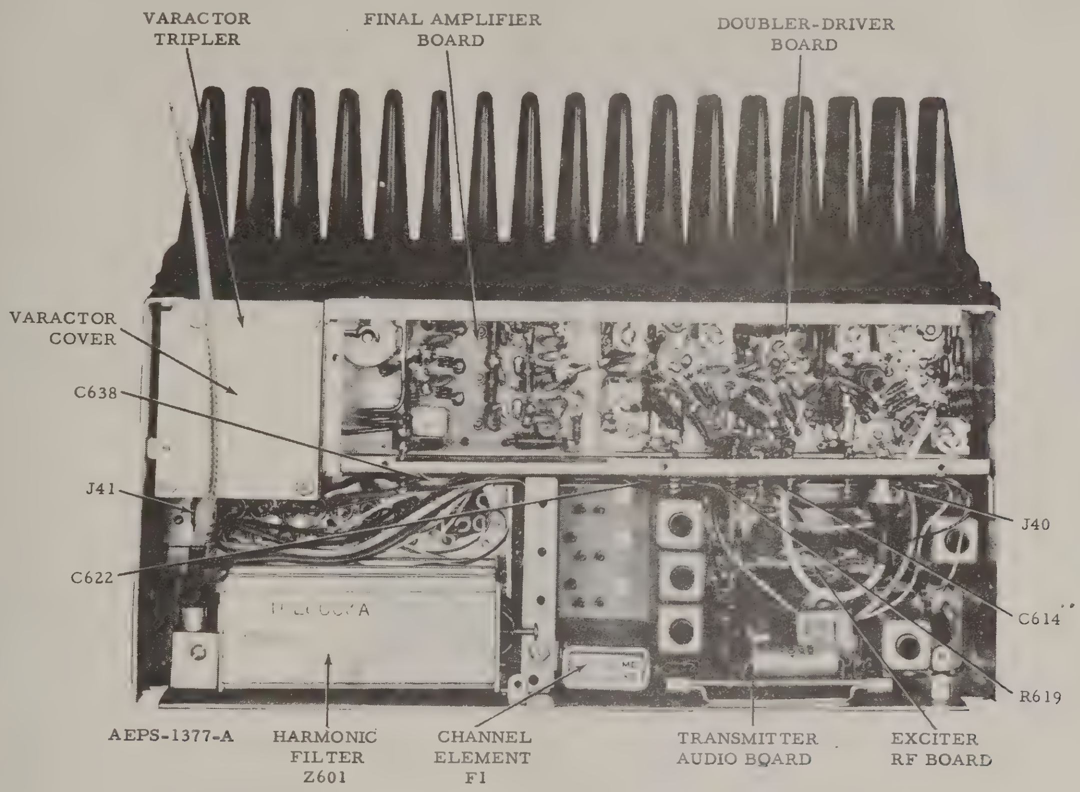
The three final amplifier transistors (Q604, Q605 or Q606) can be replaced in the same manner as previously described for the power doubler, pre-driver or driver transistors. Use the same precautions.

e. Varactor Tripler

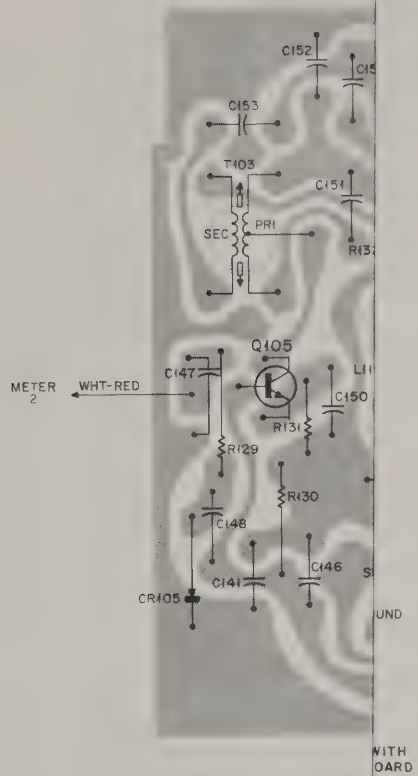
Replacement of the varactor or coils can easily be accomplished from the rear after removal of the varactor cover. If the variable capacitors must be replaced, it may be easier to remove the housing. To remove the housing, first remove the tripler input coil and the 3 screws holding the housing in the chassis. Next, remove the harmonic filter; then slide the housing down and out.



Parts Location Detail (Front View)



Parts Location Detail (Rear View)



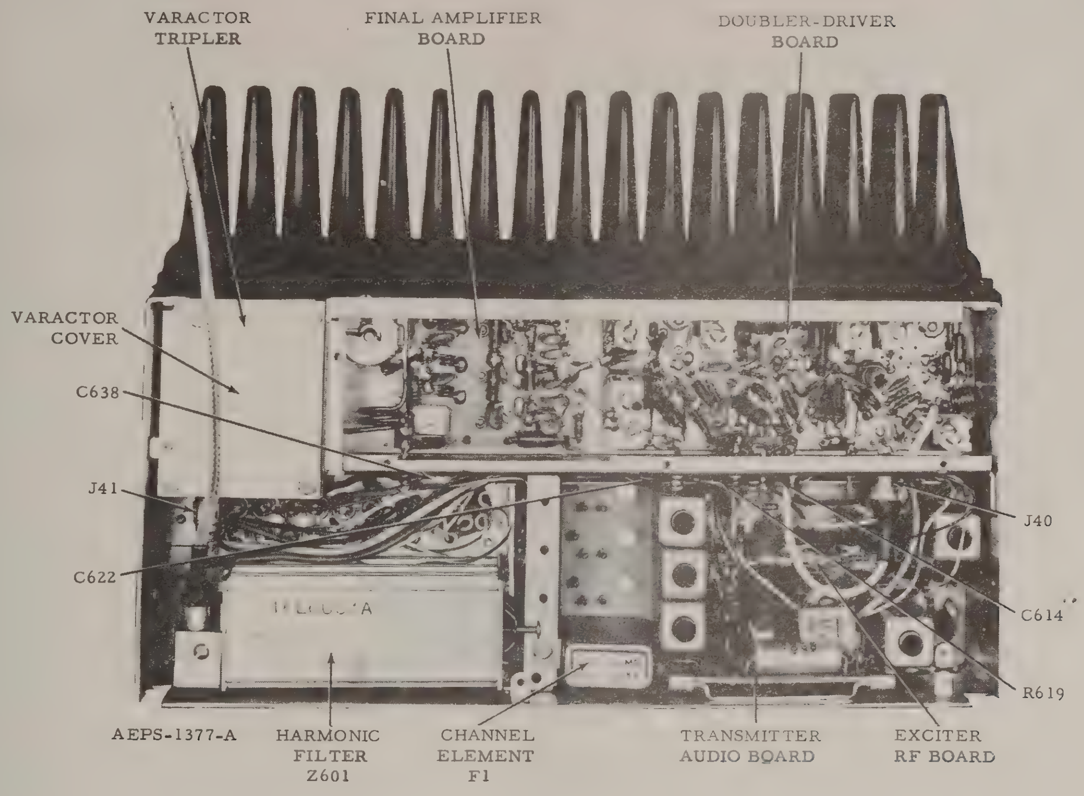
EXCITER-TRANSMITTER

ONS AND PARTS LIST
OF THIS DIAGRAM

TLE6392A &
Board TLN8956A
ils
5-714-E

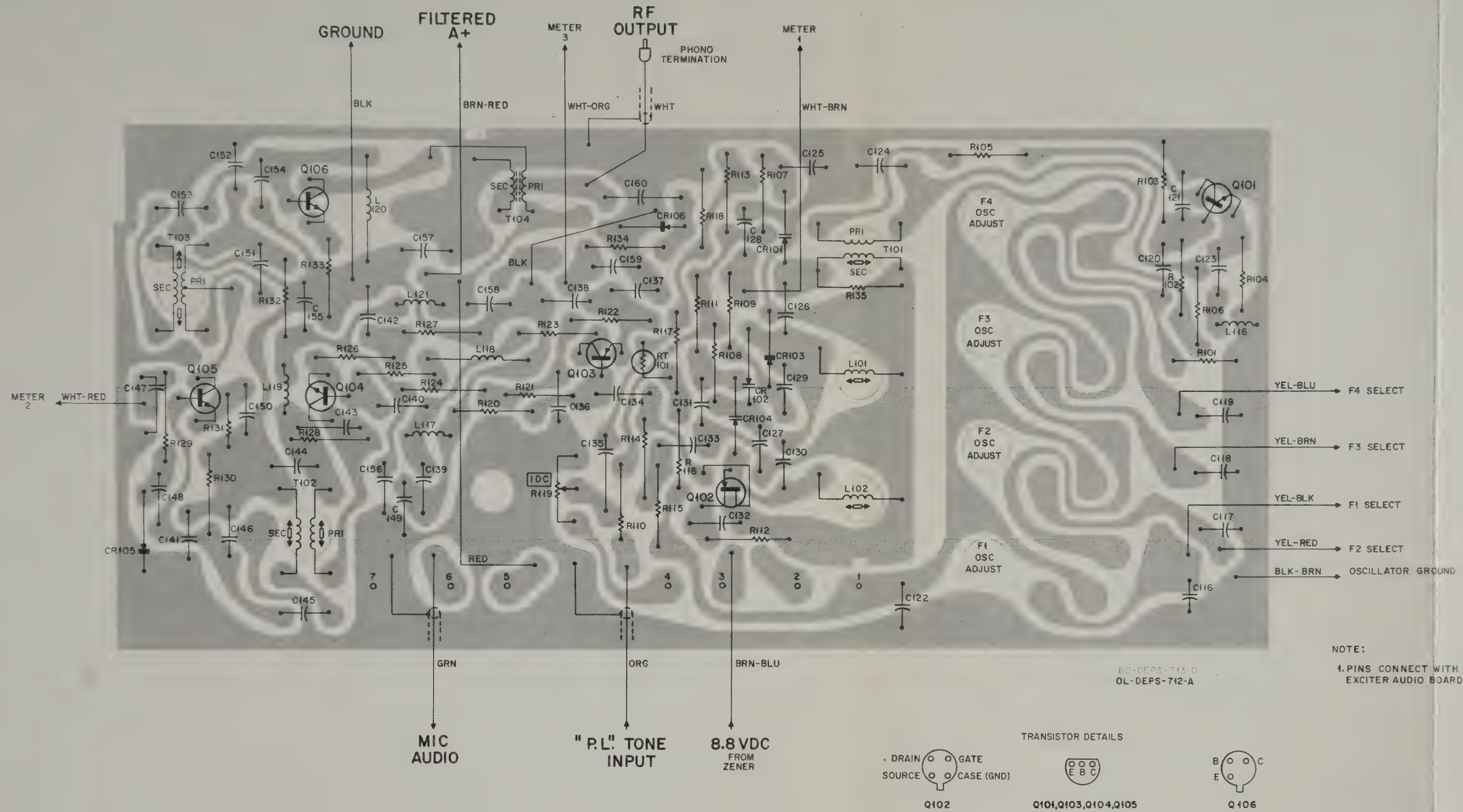
FOR MODELS TLE6392A AND TLN89
SUFFIX -1 OR LATER, REFER TO C
CUIT BOARD DETAIL PEPS-3621.

EPS-36



Parts Location Detail (Rear View)

EXCITER-TRANSMITTER



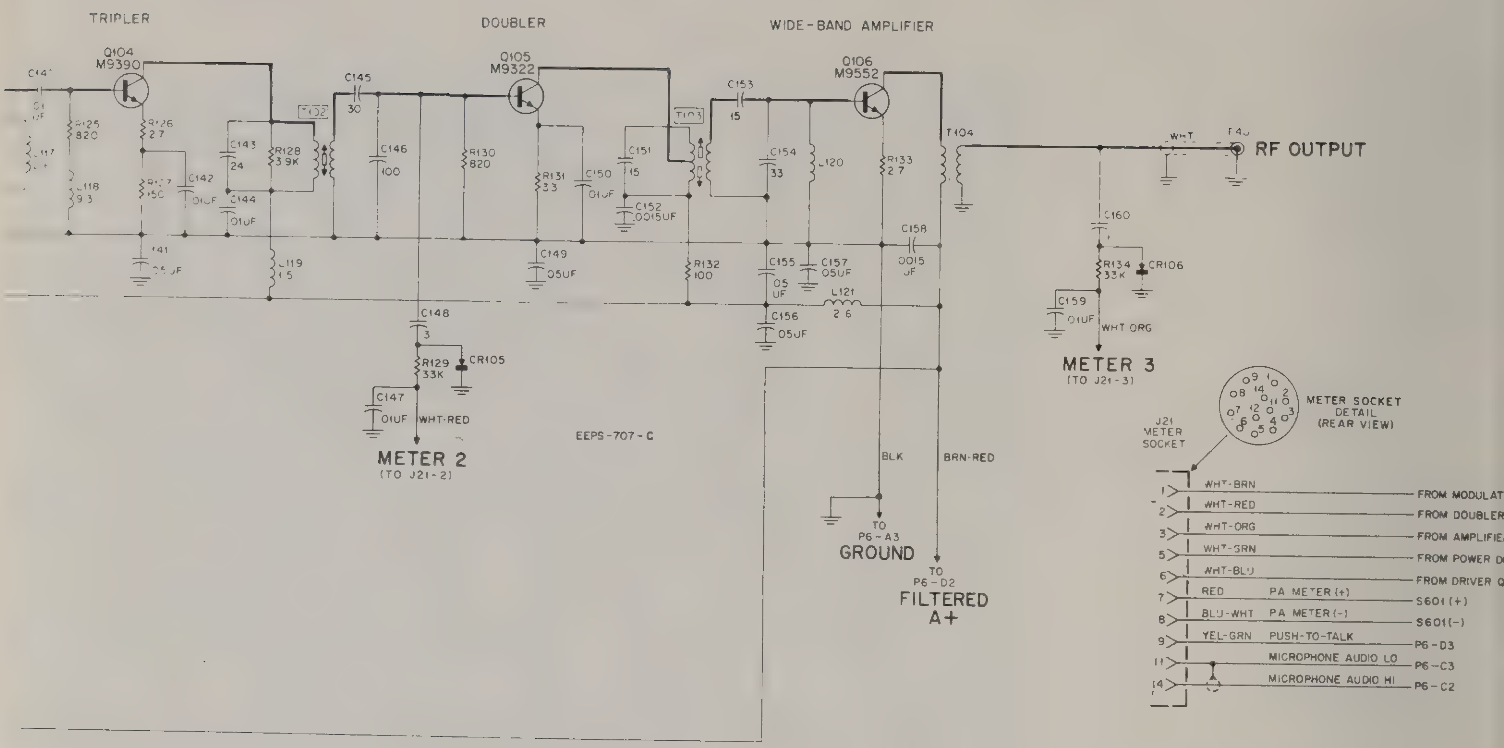
Exciter RF Board TLE6392A

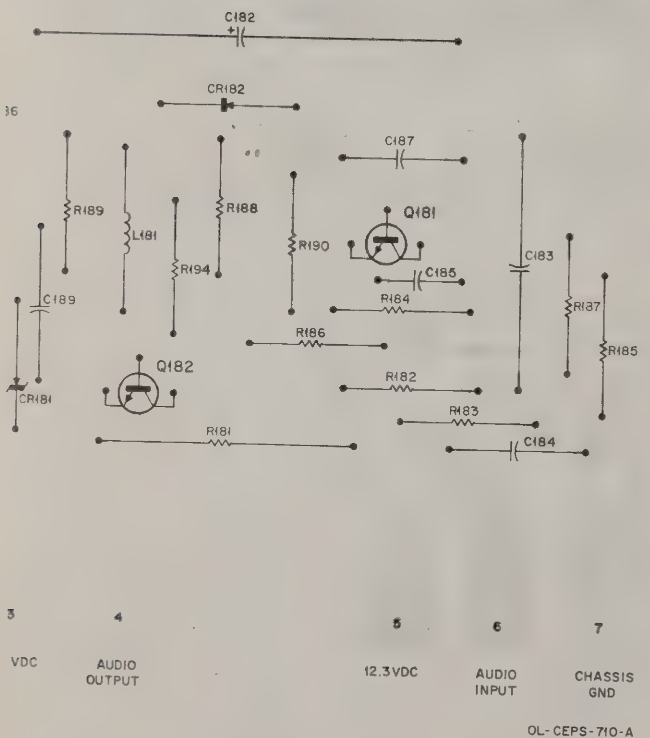
PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

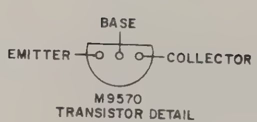
Exciter RF Board TLE6392A &
Transmitter Audio Board TLN8956A
Circuit Board Details
Motorola No. PEPS-714-E
4/21/71-UP

FOR MODELS TLE6392A AND TLN8956A SUFFIX -1 OR LATER, REFER TO CIRCUIT BOARD DETAIL PEPS-3621.

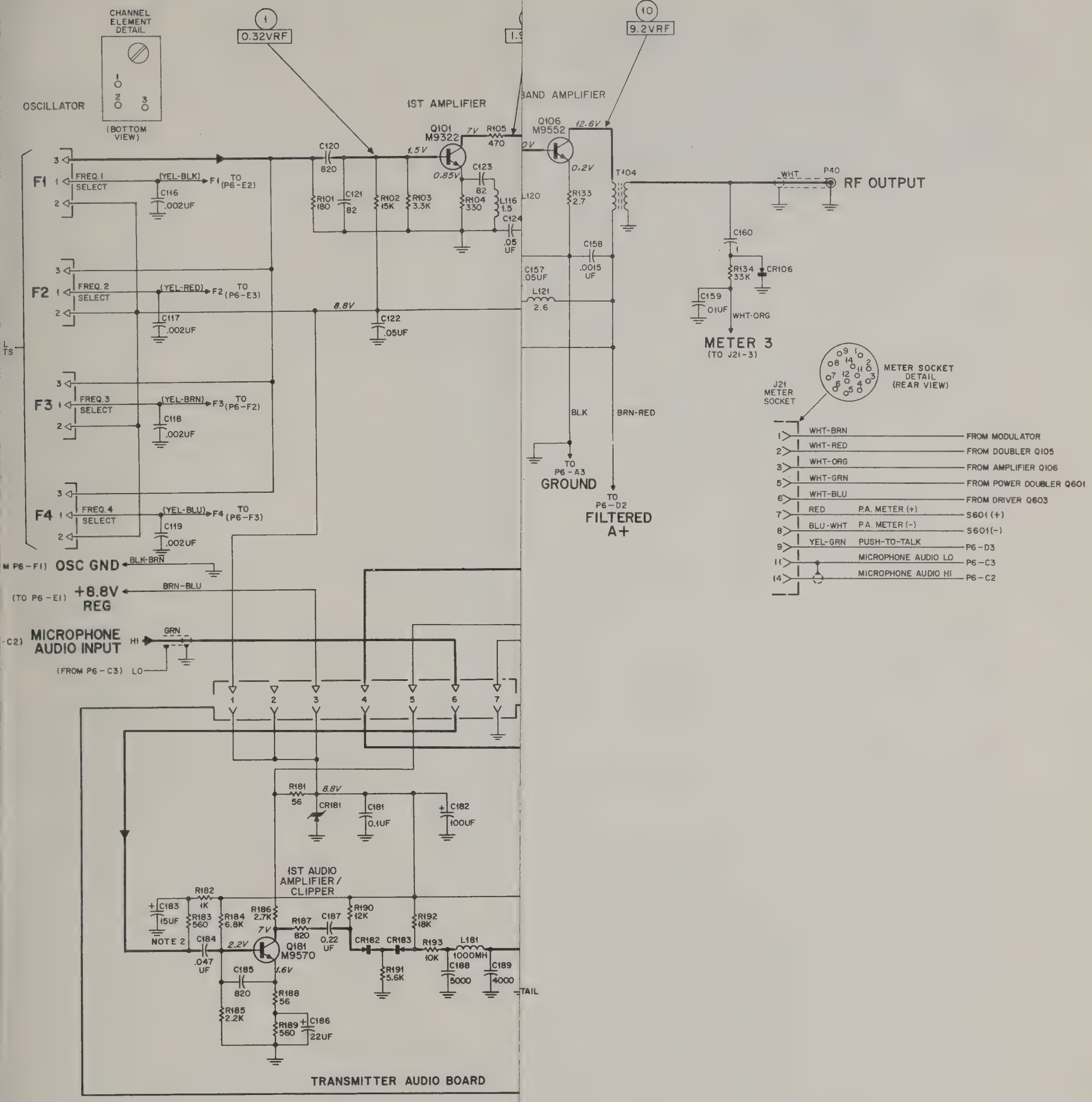
EPS-3627-O



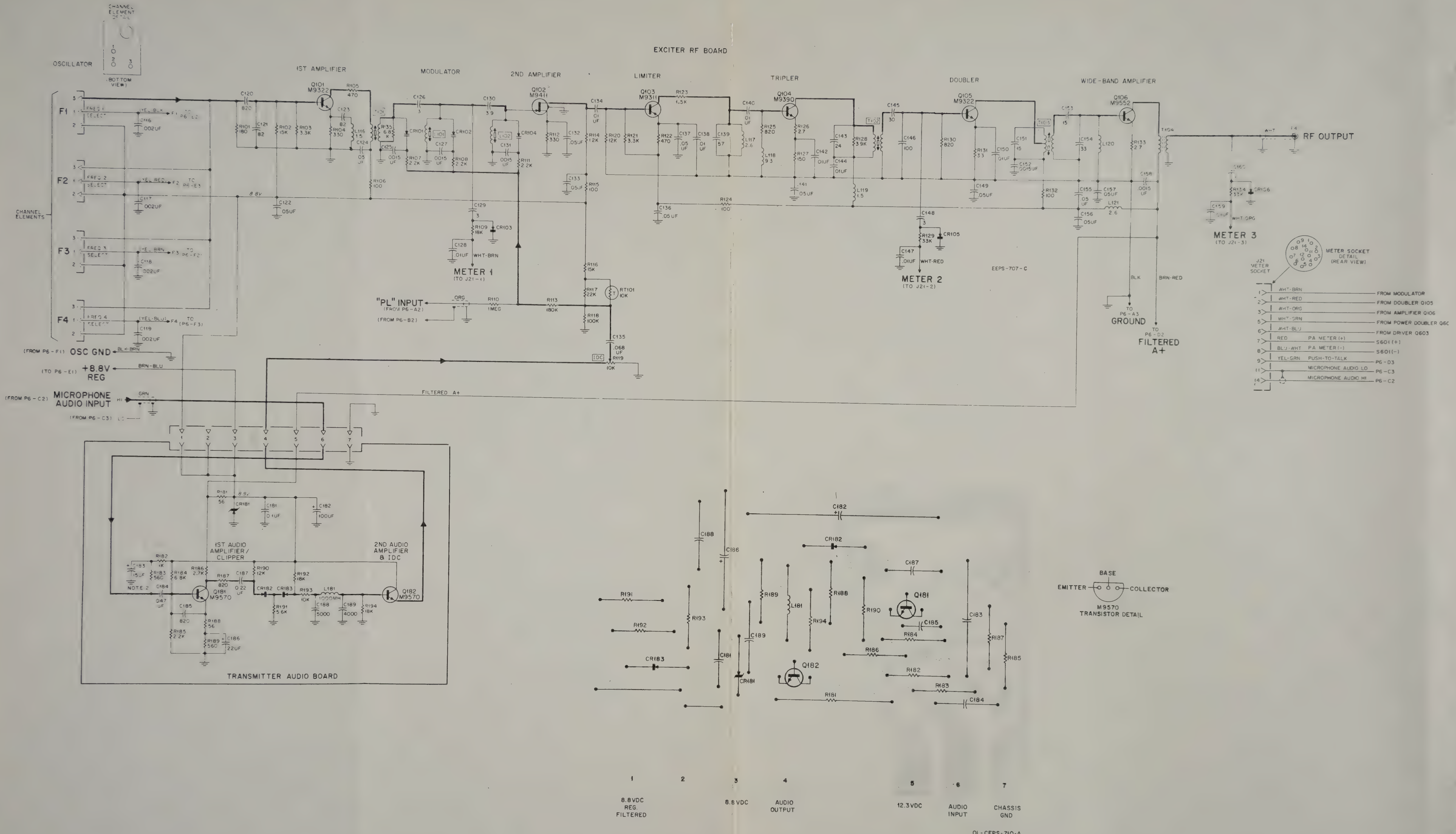




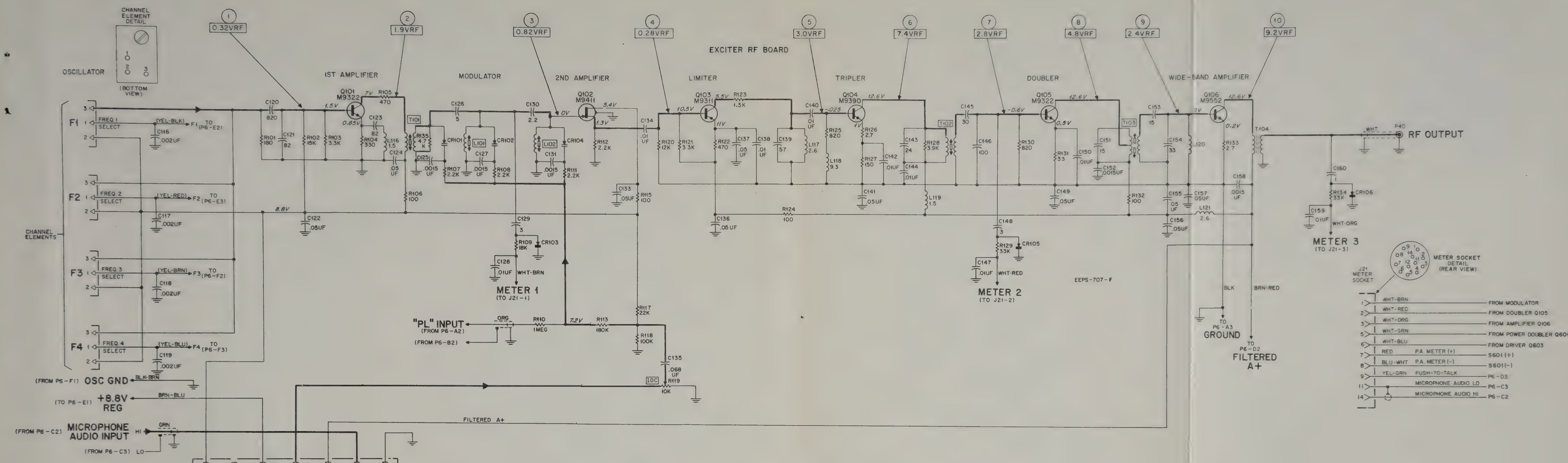
mitter Audio Board TLN8956A

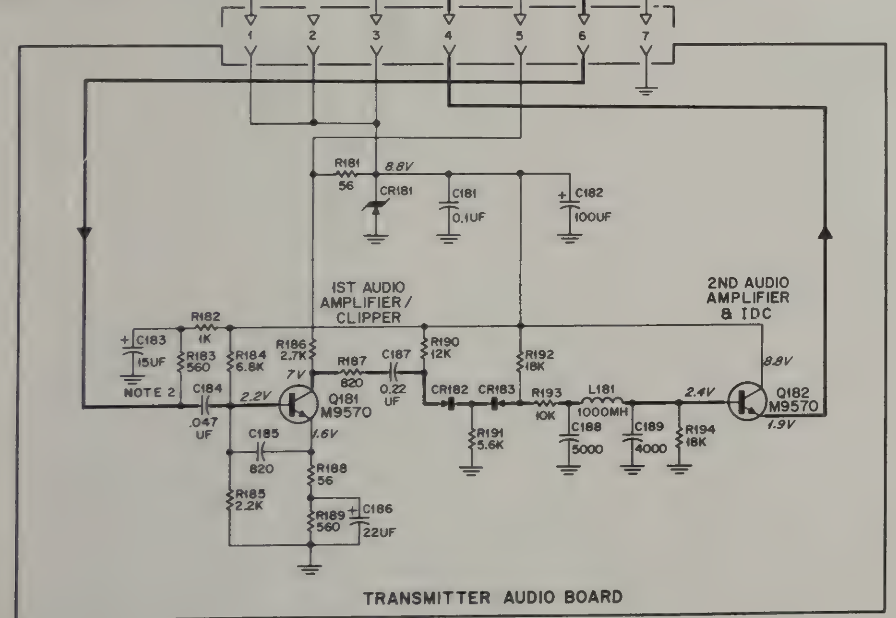


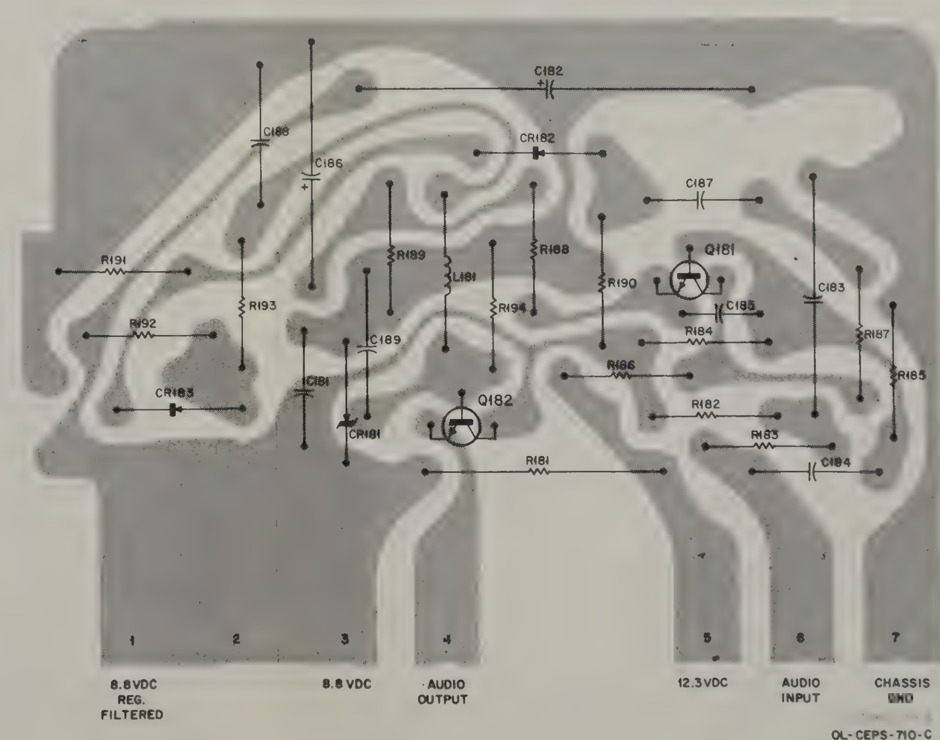
CHANNEL ELEMENT DETAIL
(BOTTOM VIEW)
OSCILLATOR
0.32VRF
9.2VRF
1ST AMPLIFIER
Q101 M9322
BAND AMPLIFIER
Q106 M9552
RF OUTPUT
P40
T104
METER 3
(TO J21-3)
METER SOCKET DETAIL (REAR VIEW)
J21 METER SOCKET
F1
F2
F3
F4
FREQ. 1 SELECT
FREQ. 2 SELECT
FREQ. 3 SELECT
FREQ. 4 SELECT
TO P6-A3
GROUND
TO P6-D2
FILTERED A+
WHT-BRN FROM MODULATOR
WHT-RED FROM DOUBLER Q105
WHT-ORG FROM AMPLIFIER Q106
WHT-GRN FROM POWER DOUBLER Q601
WHT-BLU FROM DRIVER Q603
RED P.A. METER (+) S601 (+)
BLU-WHT P.A. METER (-) S601(-)
YEL-GRN PUSH-TO-TALK P6-D3
MICROPHONE AUDIO LO P6-C3
MICROPHONE AUDIO HI P6-C2
OSC GND
+8.8V REG
(TO P6-E1)
MICROPHONE AUDIO INPUT
(FROM P6-C3)
1ST AUDIO AMPLIFIER / CLIPPER
Q181 M9570
NOTE 2
TRANSMITTER AUDIO BOARD



Transmitter Audio Board TLN8956A







Transmitter Audio Board TLN8956A

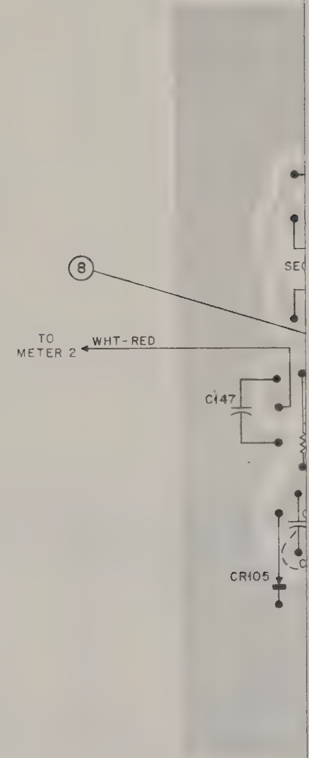
ERENCE YMBOL	MOTOROLA PART NO.	DESCRIPTION
		<u>THERMISTOR:</u>
01	6B82696B01	10K ±10% @ 25°C
		<u>TRANSFORMER, RF:</u>
1	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
2	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
3	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
6	24C83380H01	bifilar winding
NON-REFERENCED ITEMS		
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

8956A Transmitter Audio Board PL-369-O

		<u>CAPACITOR, fixed:</u>
	21C82372C01	0.1 uF +80-20%; 25 v
	23D82601A25	100 uF +150-10%; 20 v
	23D83214C02	15 uF ±20%; 25 v
	8D82905G03	.047 uF ±10%; 50 v
	21D82187B17	820 pF ±10%; 500 v
	23D83214C07	22 uF ±20%; 15 v
	8D83293B02	0.22 uF ±10%; 50 v
	21K863298	5000 pF ±1%; 500 v
	21K863396	4000 pF ±1%; 500 v
		<u>SEMICONDUCTOR DEVICE, diode:</u> (SEE NOTE)
B1	48D82256C56	silicon; zener type
B2, 183	48C82392B03	silicon
		<u>REACTOR:</u>
	25D82113H02	a-f choke; 1000 mH
		<u>TRANSISTOR:</u> (SEE NOTE)
, 182	48R869570	N-P-N; type M9570
		<u>RESISTOR, fixed: ±10%; 1/4 w</u> unl. stated
	6S2037	56
	6S127802	1K
, 189	6S129620	560
	6S128687	6.8K
	6S128689	2.2K
	6S128688	2.7K
	6S129432	820
	6S129860	56
	6S129887	12K ±5%
	6S129982	5.6K ±5%
, 194	6S131526	18K ±5%
	6S129668	10K ±5%

E:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



EXCITER-TRANSMITTER

DR MODELS TLE6392A AND TLN8956A
ITH NO SUFFIX, REFER TO CIRCUIT
DARD DETAIL PEPS-714.

EPS-3628-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Exciter RF Board TLE6392A &
Transmitter Audio Board TLN8956A
Circuit Board Details
Motorola No. PEPS-3621-E
3/22/72-UP

REVISIONS

PEPS-714-E

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE6392A	Q104	WAS 48R869322 TYPE M9322	TRIPLER
	R123	WAS 6S129708; 1.2K	
	R125	WAS 6S129806; 330	
	R126	WAS 6S124B57; 3.3	
TLE6392A-1 TLE6392A-2	R135	ADDED; 6S128687 6.8K	T101 SECONDARY
TLE6392A-3 TLN8956A-1		PRINTED CIRCUIT BOARD PLATING REVISED.	REFER TO PEPS-3621

PARTS LIST

TLE6392A Exciter Board — PL-368-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C116, 117, 118, 119	21D82428B25	.002 uF ±20%; 500 v
C120	21D82187B17	820 pF ±10%; 500 v
C121, 123	21D82610C20	82 pF ±5%; 200 v; NP0
C122, 124, 132, 133, 136, 137, 149, 155, 156, 157	21C82372C04	.05 uF +80-20%; 25 v
C125, 127, 131, 152, 158	21D82187B18	1500 pF ±10%; 100 v
C126, 129, 148	21K868935	3 pF ±0.25 pF; 2000 v; NP0
C128, 134, 138, 140, 141, 142, 144, 147, 150, 159	21D82428B59	.01 uF +80-20%; 200 v
C130	21D82133G40	3.9 pF ±0.25 pF; 500 v; NP0
C135	8C82095G04	.068 uF ±10%; 200 v
C139	21D82610C47	57 pF ±5%; 100 v; N220
C143	21D82133G74	24 pF ±5%; 500 v; N150
C145	21D82610C14	30 pF ±5%; 200 v; N150
C146	21D82610C44	100 pF ±5%; 100 v; N220
C151, 153	21S114535	15 pF ±5%; 500 v; N150
C154	21K855809	33 pF ±5%; 250 v; N150
C160	21K864518	1 pF ±10%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101, 102, 104	48D82190H08	silicon; varicap: type MV1662
CR103, 105, 106	48C82139G01	germanium
		COIL, RF
L101, 102	24D83377H01	coded RED; incl. 76B83377H01 CORE, tuning
L116, 119	24C82835G04	choke; 1.5 uH
L117, 121	24C82835G03	choke; 2.6 uH
L118	24C82835G20	choke; 9.3 uH
L120	24B83977B01	incl. ferrite body
		CONNECTOR, plug:
P40	28B82331G01	male; coaxial; min; "cinch" type
		TRANSISTOR: (SEE NOTE)
Q101, 105	48R869322	N-P-N; type M9322
Q102	48R869411	field-effect; type M9411
Q103	48R869311	P-N-P; type M9311
Q104	48R869390	N-P-N; type M9390
Q106	48R869552	N-P-N; type M9552; does not incl. 26B83379H01 HEAT SINK
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R101	6S129662	180
R102	6S127805	15K
R103, 121	6S129231	3.3K
R104	6S129775	330
R105, 122	6S127801	470
R106, 115, 124, 132	6S129753	100
R107, 108, 111	6S128689	2.2K
R109	6S128904	18K
R110	6S129189	1 meg ±5%
R112	6S129806	330 ±5%
R113	6S124B04	180K ±5%
R114	6S129235	1.2K
R116	6S129236	15K ±5%
R117	6S129667	22K ±5%
R118	6S124A97	100K ±5%
R119	18D82238D15	var: 10K
R120	6S129230	12K
R123	6S129681	1.5K ±5%
R125	6S129818	820 ±5%
R126, 133	6S124B55	2.7 ±5%
R127	6S129862	150
R128	6S129819	3.9K ±5%
R129, 134	6S127807	33K
R130	6S129432	820
R131	6S129754	33
R135	6S128687	6.8K

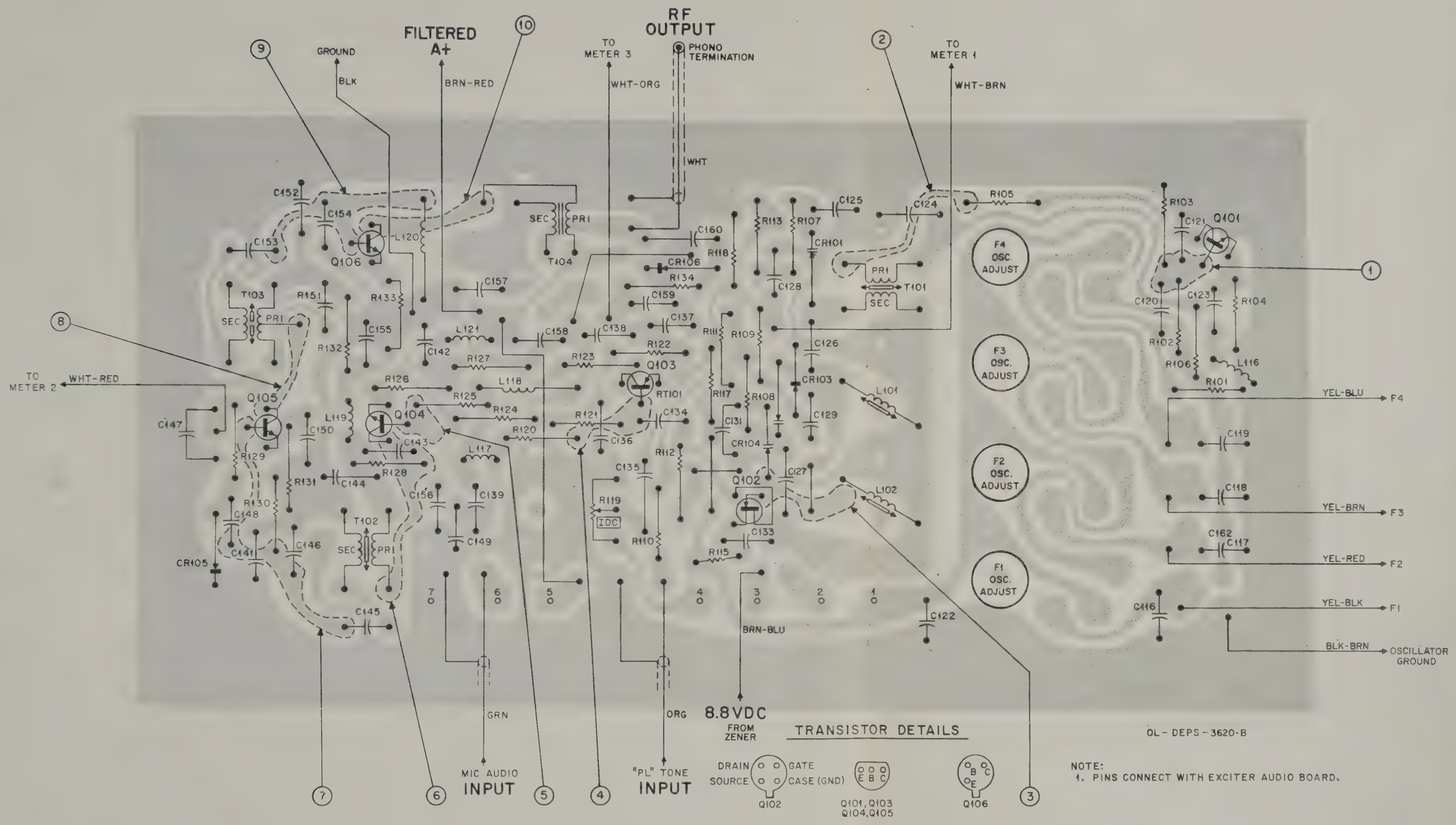
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		THERMISTOR:
RT101	6B82696B01	10K ±10% @ 25°C
		TRANSFORMER, RF
T101	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
T102	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
T103	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
T116	24C83380H01	bifilar winding
		NON-REFERENCED ITEMS
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

TLN8956A Transmitter Audio Board — PL-369-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C181	21C82372C01	0.1 uF +80-20%; 25 v
C182	23D82601A25	100 uF +150-10%; 20 v
C183	23D83214C02	15 uF ±20%; 25 v
C184	8D82905G03	.047 uF ±10%; 50 v
C185	21D82187B17	820 pF ±10%; 500 v
C186	23D83214C07	22 uF ±20%; 15 v
C187	8D83293B02	0.22 uF ±10%; 50 v
C188	21K863298	5000 pF ±1%; 500 v
C189	21K863396	4000 pF ±1%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR181	48D82256C56	silicon; zener type
CR182, 183	48C82392B03	silicon
		REACTOR:
L181	25D82113H02	a-f choke; 1000 mH
		TRANSISTOR: (SEE NOTE)
Q181, 182	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±10%; 1/4 w unl. stated
R181	6S2037	56
R182	6S127802	1K
R183, 189	6S129620	560
R184	6S128687	6.8K
R185	6S128689	2.2K
R186	6S128688	2.7K
R187	6S129432	820
R188	6S129860	56
R190	6S129887	12K ±5%
R191	6S129982	5.6K ±5%
R192, 194	6S131526	18K ±5%
R193	6S129668	10K ±5%

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



Exciter RF Board TLE6392A - 4

FOR MODELS TLE6392A AND TLN8956A WITH NO SUFFIX, REFER TO CIRCUIT BOARD DETAIL PEPS-714.

EPS-3628-O

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

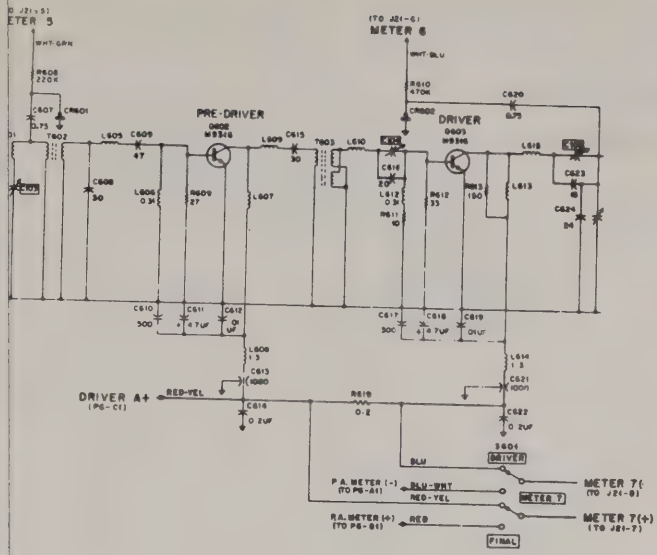
Exciter RF Board TLE6392A &
Transmitter Audio Board TLN8956A
Circuit Board Details
Motorola No. PEPS-3621-E
3/22/72-UP

MOTOROLA PART NO.	DESCRIPTION
	TRANSFORMER, RF:
24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
24C83380H01	bifilar winding
NON-REFERENCED ITEMS	
1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
26A84000A01	SHIELD, coil: used with T116

_ransmitter Audio Board PL-369-O

	CAPACITOR, fixed:
21C82372C01	0.1 uF +80-20%; 25 v
23D82601A25	100 uF +150-10%; 20 v
23D83214C02	15 uF ±20%; 25 v
8D82905G03	.047 uF ±10%; 50 v
21D82187B17	820 pF ±10%; 500 v
23D83214C07	22 uF ±20%; 15 v
8D83293B02	0.22 uF ±10%; 50 v
21K863298	5000 pF ±1%; 500 v
21K863396	4000 pF ±1%; 500 v
	SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
48D82256C56	silicon; zener type
48C82392B03	silicon
	REACTOR:
25D82113H02	a-f choke; 1000 mH
	TRANSISTOR: (SEE NOTE)
48R869570	N-P-N; type M9570
	RESISTOR, fixed: ±10%; 1/4 w unl. stated
6S2037	56
6S127802	1K
6S129620	560
6S128687	6.8K
6S128689	2.2K
6S128688	2.7K
6S129432	820
6S129860	56
6S129887	12K ±5%
6S129982	5.6K ±5%
6S131526	18K ±5%
6S129668	10K ±5%

nent diodes and transistors must be ordered by
part number only for optimum performance.



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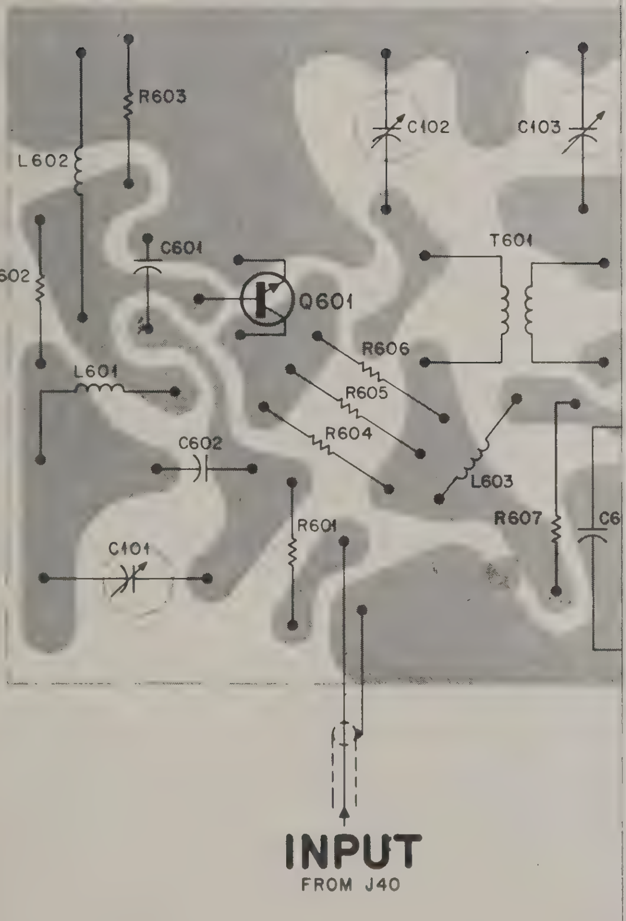


EXCITER-TRANSMITTER

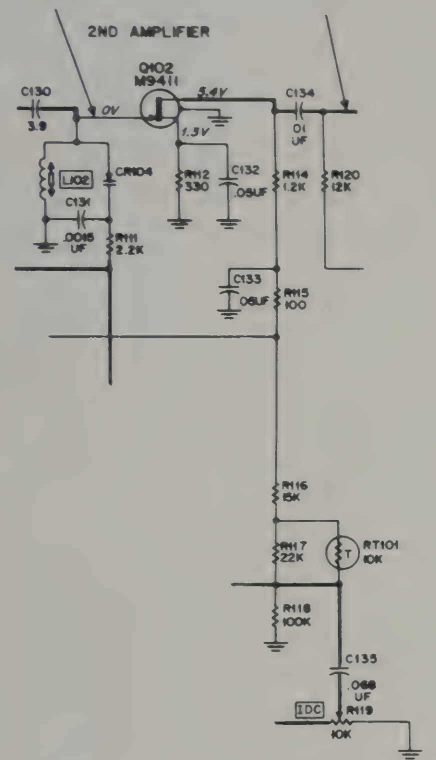
PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLN4220A Doubler-Driver
Circuit Board Detail
Motorola No. PEPS-2593-A
4/21/71-UP

REVISIONS

PEPS-3621-E

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE6392A-4	C125, 131	WERE 21D82187B18, 1500 pF	2ND. AMPL. CKT.
	C127	WAS 21D82187B11, 1500 pF	
	C130	WAS 21D82133G40, 3.9 pF	
	C126	WAS 21K868935, 3 pF	
	R115	WAS 6S129753, 100; 1/4 W	
	R112	WAS 6S129806, 330	
	R114	REMOVED 6S129235, 1.2K	
	R116	REMOVED 6S129236, 15K	
	R135	WAS 6S128687, 6.8K	
	RT101	REMOVED 6B82696B01, 10K CIRCUIT WAS AS SHOWN BELOW:	



BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
	CR101, 102, 104	FROM 48D82190H08, MV1662 TO 48D82190H17, SMV489	PARTS LIST
	R122	FROM 6S127801, 470 TO 6S129804, 2.2K	Q103 EMITTER
	R135	FROM 6S127804, 4.7K TO 6S129804, 2.2K	T101

PARTS LIST

TLE6392A Exciter Board — PL-368-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C116, 117, 118, 119	21D82428B25	.002 uF ±20%; 500 v
C120	21D82187B17	820 pF ±10%; 500 v
C121, 123	21D82610C20	82 pF ±5%; 200 v; NPO
C122, 124, 133, 136, 137, 149, 155, 156, 157	21C82372C04	.05 uF +80-20%; 25 v
C125, 127, 131	21D84426B63	1500 pF ±5%; 500 v
C126	21D83406D65	5 pF ±5%; 500 v; NPO
C128, 134, 138, 140, 141, 142, 144, 147, 150, 159	21D82428B59	.01 uF +80-20%; 200 v
C129, 148	21K868935	3 pF ±0.25 pF; 2000 v; NPO
C130	21D82204B26	2.2 pF ±0.1 pF; 500 v; NPO
C135	8C82095G04	.068 uF ±10%; 200 v
C139	21D82610C47	57 pF ±5%; 100 v; N220
C143	21D82133G74	24 pF ±5%; 500 v; N150
C145	21D82610C14	30 pF ±5%; 200 v; N150
C146	21D82610C44	100 pF ±5%; 100 v; N220
C151, 153	21S114535	15 pF ±5%; 500 v; N150
C152, 158	21D82187B18	1500 pF ±10%; 100 v
C154	21K855809	33 pF ±5%; 250 v; N150
C160	21K864518	1 pF ±10%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101, 102, 104	48D82190H17	silicon; varicap; type SMV489
CR103, 105, 106	48C82139G01	germanium
		COIL, RF:
L101, 102	24D83377H01	coded RED; incl. 76B83377H01 CORE, tuning
L116, 119	24C82835G04	choke; 1.5 uH
L117, 121	24C82835G03	choke; 2.6 uH
L118	24C82835G20	choke; 9.3 uH
L120	24B83977B01	incl. ferrite body
		CONNECTOR, plug:
P40	28B82331G01	male; coaxial; min; "cinch" type
		TRANSISTOR: (SEE NOTE)
Q101, 105	48R869322	N-P-N; type M9322
Q102	48R869411	field-effect; type M9411
Q103	48R869311	P-N-P; type M9311
Q104	48R869390	N-P-N; type M9390
Q106	48R869552	N-P-N; type M9552; does not incl. 26B83379H01 HEAT SINK
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R101	6S129662	180
R102	6S127805	15K
R103, 121	6S129231	3.3K
R104	6S129775	330
R105,	6S127801	470
R106, 124, 132	6S129753	100
R107, 108, 111	6S128689	2.2K
R109	6S128904	18K
R110	6S129189	1 meg ±5%
R112, 122, 135	6S129804	2.2K ±5%
R113	6S124B04	180K ±5%
R115	6S185B67	100; 1/8 w
R117	6S129667	22K ±5%
R118	6S124A97	100K ±5%
R119	18D82238D15	var: 10K
R120	6S129230	12K
R123	6S129681	1.5K ±5%
R125	6S129818	820 ±5%
R126, 133	6S124B55	2.7 ±5%
R127	6S129862	150
R128	6S129819	3.9K ±5%
R129, 134	6S127807	33K
R130	6S129432	820
R131	6S129754	33

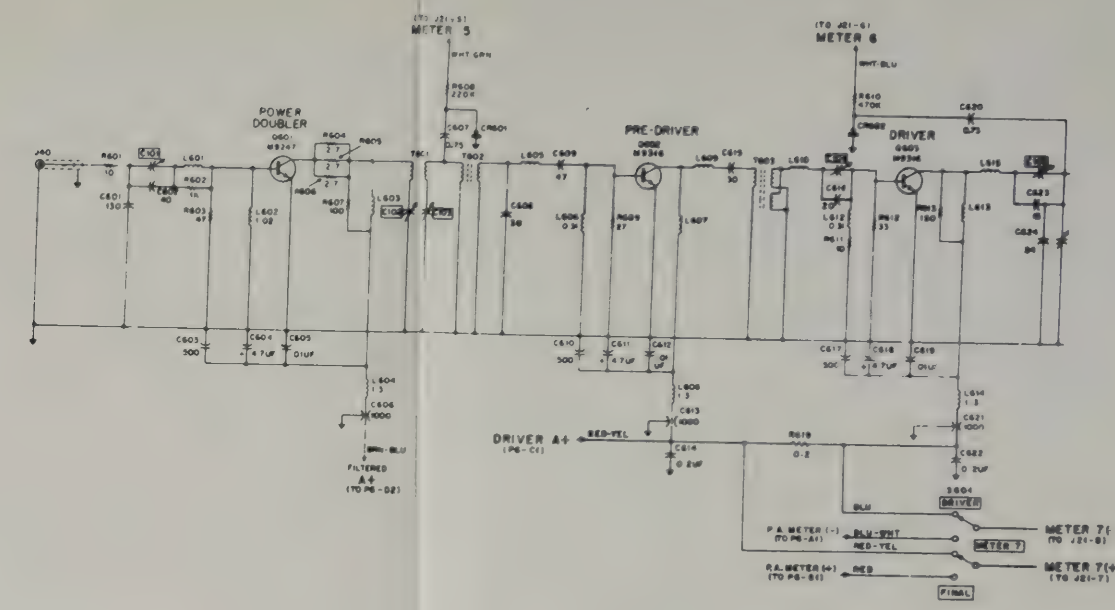
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER, RF:
T101	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
T102	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
T103	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
T116	24C83380H01	bifilar winding
	NON-REFERENCED ITEMS	
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

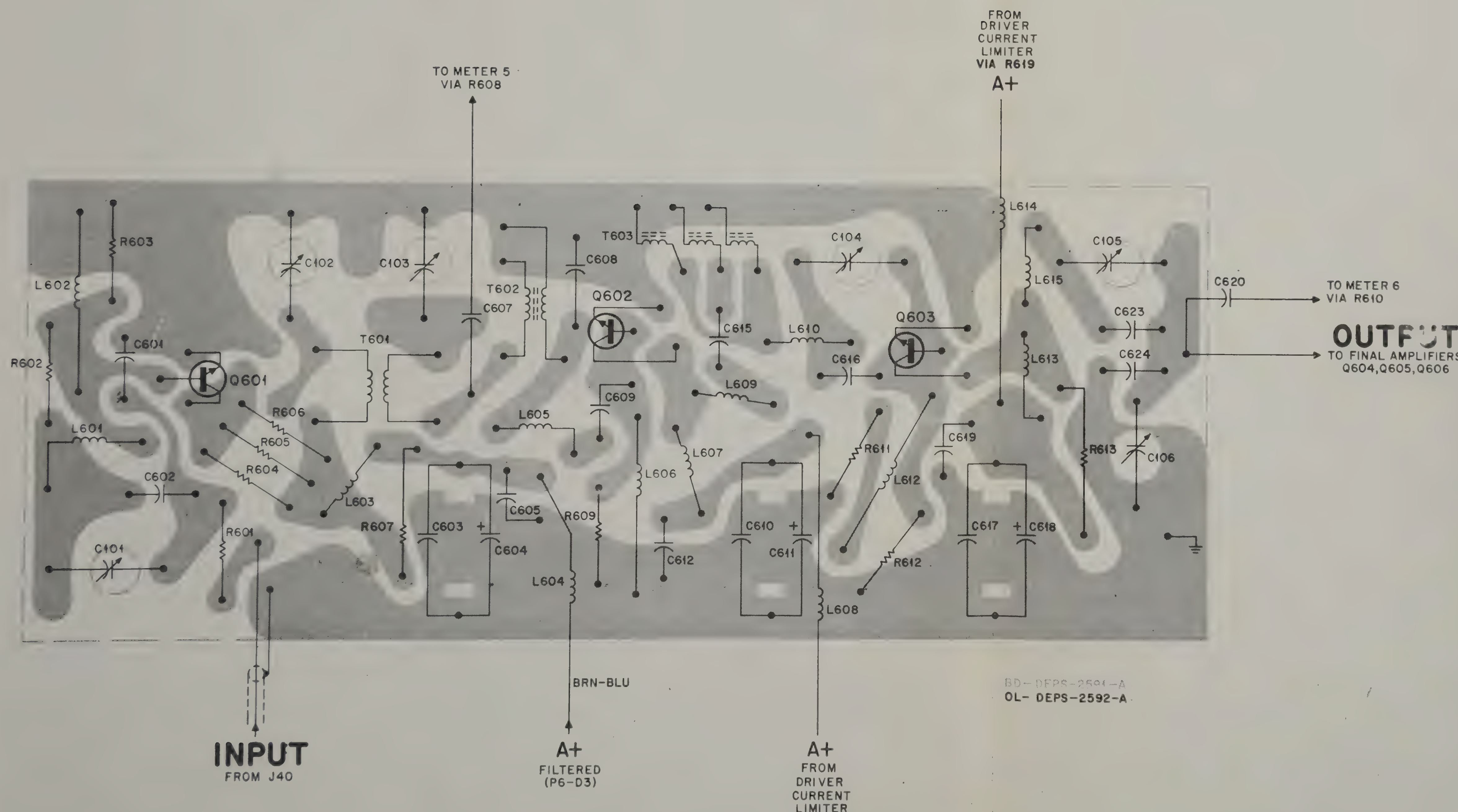
TLN8956A Transmitter Audio Board — PL-369-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C181	21C82372C01	0.1 uF +80-20%; 25 v
C182	23D82601A25	100 uF +150-10%; 20 v
C183	23D83214C02	15 uF ±20%; 25 v
C184	8D82905G03	.047 uF ±10%; 50 v
C185	21D82187B17	820 pF ±10%; 500 v
C186	23D83214C07	22 uF ±20%; 15 v
C187	8D83293B02	0.22 uF ±10%; 50 v
C188	21K863298	5000 pF ±1%; 500 v
C189	21K863396	4000 pF ±1%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR181	48D82256C56	silicon; zener type
CR182, 183	48C82392B03	silicon
		REACTOR:
L181	25D82113H02	a-f choke; 1000 mH
		TRANSISTOR: (SEE NOTE)
Q181, 182	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±10%; 1/4 w unl. stated
R181	6S2037	56
R182	6S127802	1K
R183, 189	6S129620	560
R184	6S128687	6.8K
R185	6S128689	2.2K
R186	6S128688	2.7K
R187	6S129432	820
R188	6S129860	56
R190	6S129887	12K ±5%
R191	6S129982	5.6K ±5%
R192, 194	6S131526	18K ±5%
R193	6S129668	10K ±5%

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLN4220A Doubler-Driver
Circuit Board Detail
Motorola No. PEPS-2593-A
4/21/71-UP

ERENCE MBOL	MOTOROLA PART NO.	DESCRIPTION

TS LIST

01B33 Doubler-Driver Board (P/O TLE6412A) PL-678-O

		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
104 06	19C83491E04	var: 2.2-21.9; 500 V ac
103	19C83491E05	var: 1-9
	21K859941	130
	21D82610C45	40; 100 V; NP0
610	21K82880E19	500 ±10%
611	23K865137	4.7 uF ±20%; 25 V
612	21K832501	.01 uF +60-40%; 250 V
620	21C82450B06	0.75 ±10%
	21K852185	36; NP0
	21D83406D06	39; N220
	21D82355B11	30; NP0
624	21K840365	24; NP0
	21K82989E33	15 ±2.5%; NP0
		COIL, RF:
	24C84154A01	4-1/4 turns
	24K890687	choke; 1.02 uH
607	24C84153A01	2-1/4 turns
608	24K832590	choke; 1.3 uH
609 15	24C84152A01	1-1/4 turns
612	24K800484	choke; 0.31 uH
		TRANSISTOR (SEE NOTE)
602	48R869247	N-P-N; type M9247; does not incl. 14A83211B01 INSULATOR mtg.
	48R869316	N-P-N; type M9316; does not incl. 14A83211B01 INSULATOR mtg.
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
611	6S129755	10
	6S127802	1K
	6S129233	47
605	6S124B55	2.7 ±5%
	6S129753	100
	6S129754	33
	6S129862	150
		TRANSFORMER: RF:
	24C84151A01	pri: 4-1/2 turns sec: 4-1/2 turns (windings spaced apart)
	24C84149A01	(bifilar winding); pri: coded RED sec: coded GRN
	24C84150A01	(bifilar winding)

placement transistors must be ordered by Motorola rt number only for optimum performance.

METER 6
A R610

OUTPUT

FINAL AMPLIFIERS
Q604,Q605,Q606

EXCITER-TRANSMITTER

1V80701B33 Doubler-Driver
Circuit Board Detail
Motorola No. PEPS-1319-D
4/21/71-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN4220A Doubler Driver Board PL-659-O

		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C101, 104, 105, 106	19C83491E04	var: 2.2-21.9; 500 V ac
C102, 103	19C83491E05	var: 1-9
C601	21K865444	130 ±3%
C602	21D82610C45	40; 100 V; NP0
C603, 610, 617	21D82880E19	500 ±10%
C604, 611, 618	23K865137	4.7 uF ±20%; 25 V
C605, 612, 619	21K832501	.01 uF +60-40%; 250 V
C607, 620	21C82450B06	0.75 ±10%
C608	21D82355B07	30; N330
C609	21R132265	47; NP0
C615	21D82355B11	30; NP0
C623	21K82989E33	15 ±2.5%; NP0
C624	21K840365	24; NP0
C616	21D82610C22	20; NP0
		COIL, RF:
L601	24C84154A01	4-1/4 turns
L602	24K890687	choke; 1.02 uH
L603, 607, 613	24C84153A01	2-1/4 turns
L604, 608, 614	24K832590	choke; 1.3 uH
L605, 609, 610, 615	24C84152A01	1-1/4 turns
L606, 612	24K800484	choke; 0.31 uH
		TRANSISTOR: (SEE NOTE)
Q601	48R869247	N-P-N; type M9247; does not incl. 14A83211B01 INSULATOR mtg
Q602, 603	48R869316	N-P-N; type M9316; does not incl. 14A83211B01 INSULATOR mtg
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R601, 611	6S129755	10
R602	6S127802	1K
R603	6S129233	47
R604, 605, 606	6S124B55	2.7 ±5%
R607	6S6326	100; 1/2 W
R609	6S131594	27
R612	6S129754	33
R613	6S6373	150; 1/2 W
		TRANSFORMER, RF:
T601	24C84151A01	pri: 4-1/2 turns sec: 4-1/2 turns (windings spaced apart)
T602	24C84149A01	(bifilar winding); pri; coded RED sec: coded GRN
T603	24C84150A01	(bifilar winding)

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

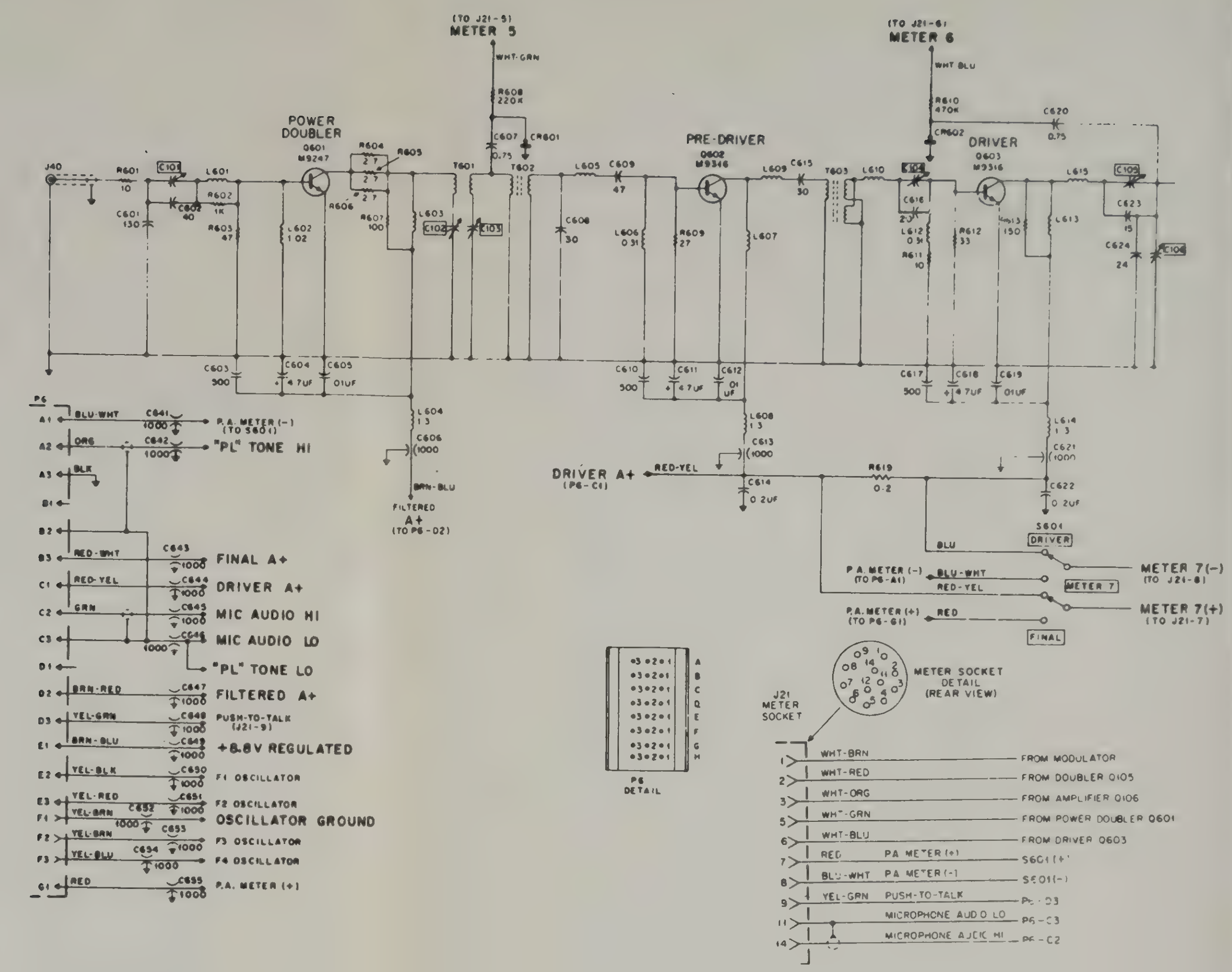
PARTS LIST

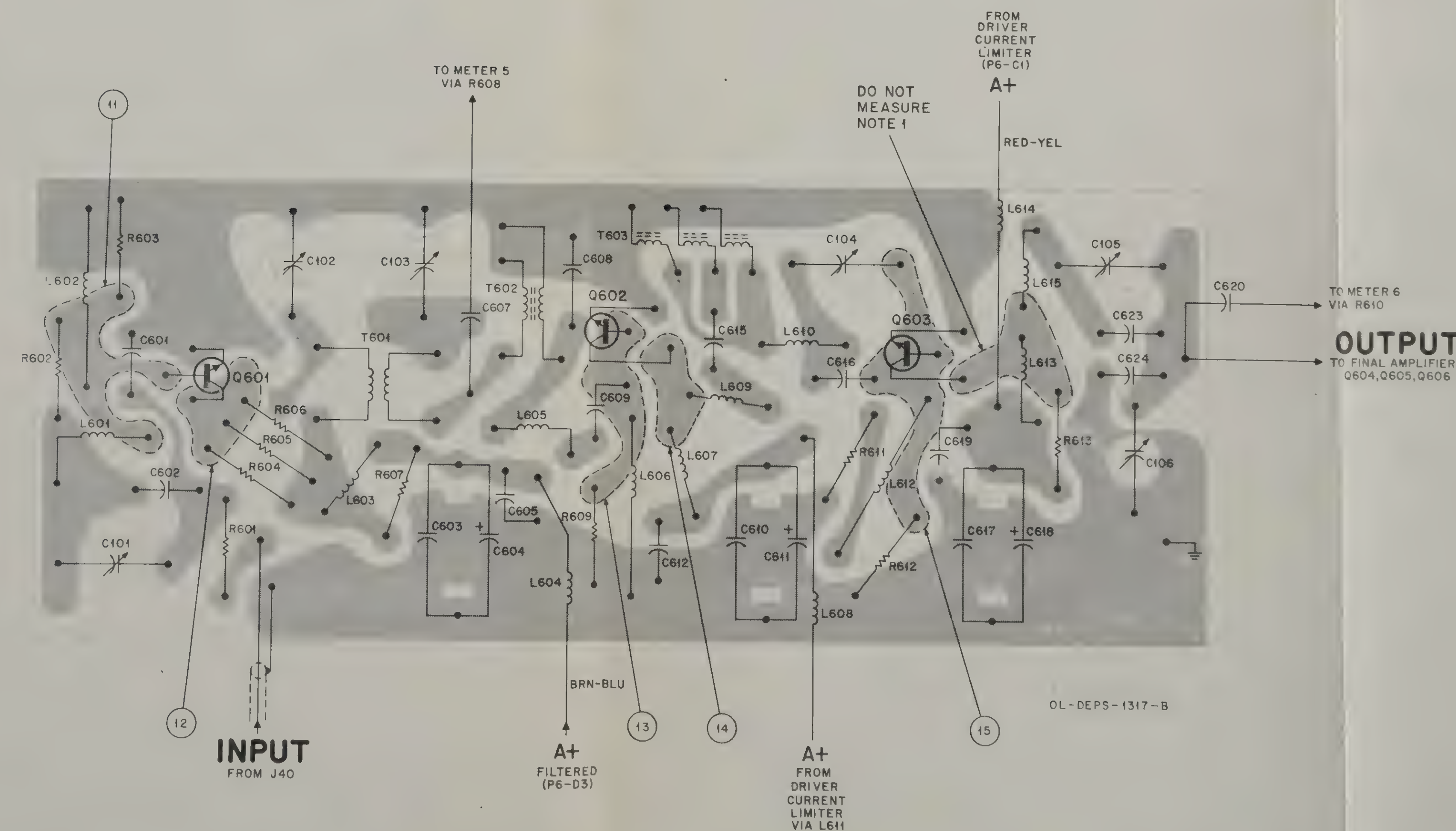
1V80701B33 Doubler-Driver Board (P/O TLE6412A) PL-678-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C101, 104 105, 106	19C83491E04	var: 2.2-21.9; 500 V ac
C102, 103	19C83491E05	var: 1-9
C601	21K859941	130
C602	21D82610C45	40; 100 V; NP0
C603, 610 617	21K82880E19	500 ±10%
C604, 611 618	23K865137	4.7 uF ±20%; 25 V
C605, 612 619	21K832501	.01 uF +60-40%; 250 V
C607, 620	21C82450B06	0.75 ±10%
C608	21K852185	36; NP0
C609	21D83406D06	39; N220
C615	21D82355B11	30; NP0
C616, 624	21K840365	24; NP0
C623	21K82989E33	15 ±2.5%; NP0
		COIL, RF:
L601	24C84154A01	4-1/4 turns
L602	24K890687	choke; 1.02 uH
L603, 607 613	24C84153A01	2-1/4 turns
L604, 608 614	24K832590	choke; 1.3 uH
L605, 609 610, 615	24C84152A01	1-1/4 turns
L606, 612	24K800484	choke; 0.31 uH
		TRANSISTOR (SEE NOTE)
Q601, 602	48R869247	N-P-N; type M9247; does not incl. 14A83211B01 INSULATOR mtg.
Q603	48R869316	N-P-N; type M9316; does not incl. 14A83211B01 INSULATOR mtg.
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R601, 611	6S129755	10
R602	6S127802	1K
R603	6S129233	47
R604, 605	6S124B55	2.7 ±5%
R607	6S129753	100
R612	6S129754	33
R613	6S129862	150
		TRANSFORMER: RF:
T601	24C84151A01	pri: 4-1/2 turns sec: 4-1/2 turns (windings spaced apart)
T602	24C84149A01	(bifilar winding); pri: coded RED sec: coded GRN
T603	24C84150A01	(bifilar winding)

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.





1V80701B33 Doubler-Driver
Circuit Board Detail
Motorola No. PEPS-1319-D
4/21/71-UP

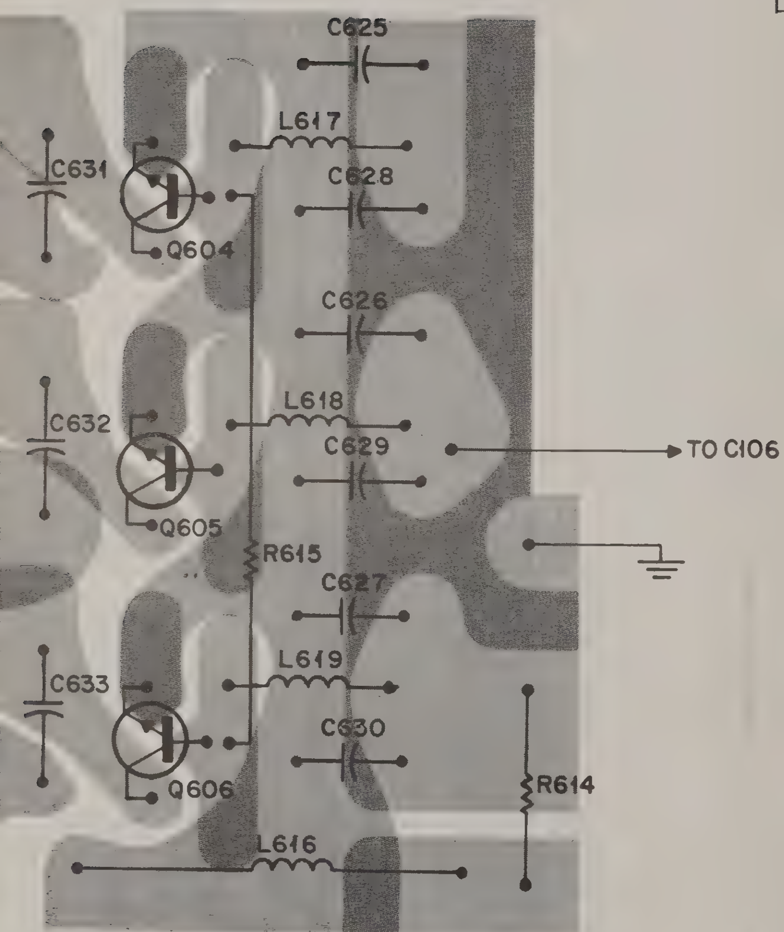
PARTS LIST

1V80701B35 Power Amplifier (P/O TLE6512A) PL-676-0

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR fixed: pF; 500 V; unl. stated
C625 thru 630	21D82355B26	10 ±0.25 pF; NP0
C631 thru 633	21D82204B03	6 ±0.5 pF; NP0
C634 thru 636	21K848525	16 ±5%; NP0
C637	21D82880E19	500 ±10%
C639	21C82372C05	0.2 uF +80-20%; 25 V
		COIL, RF:
L616	24V80900A86	choke; 1.02 uH; sleeved; code BRN, V10
L617 thru 619	24B83656E01	1 turn
L620 thru 622	24B83656E02	2 turns
L623	24C82000E26	choke; sleeved; coded ORG
L624	24C82000E25	choke; sleeved; coded BLU
		TRANSISTOR, N-P-N: (SEE NOTE)
Q604 thru 606	48R869316	type M9316; does not incl. 14A83211B01 INSULATOR mtg.
		RESISTOR, fixed:
R614	6S124B67	8.2 ±5%; 1/4 W
R615 thru 617	6S5621	10 ±10%; 1/2 W

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.

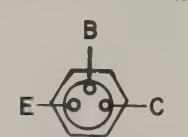


(TOP) 3D-CEPD-19182-0

OL-CEPS-1315-0

(BOTTOM) 3D-CEPD-19183-0

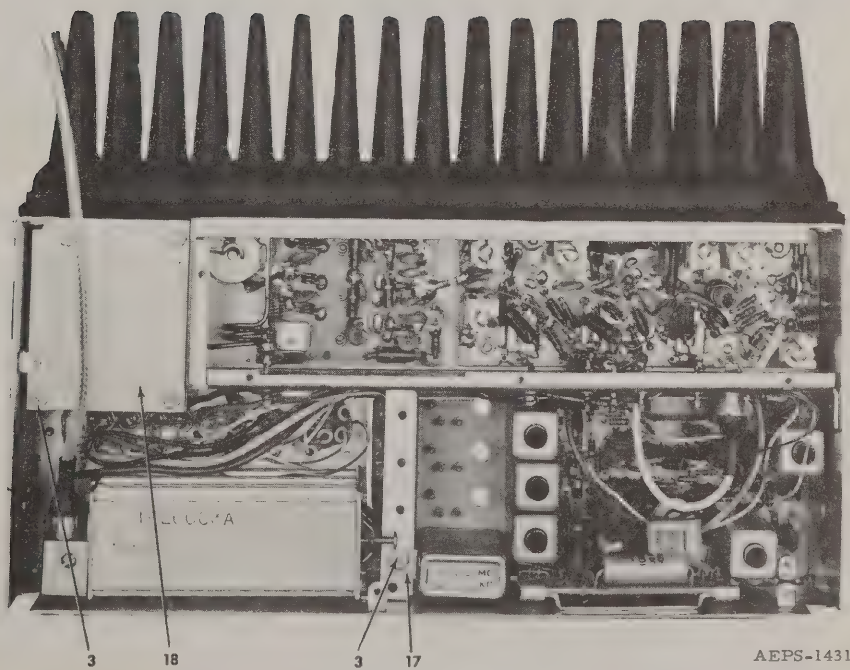
TRANSISTOR DETAIL



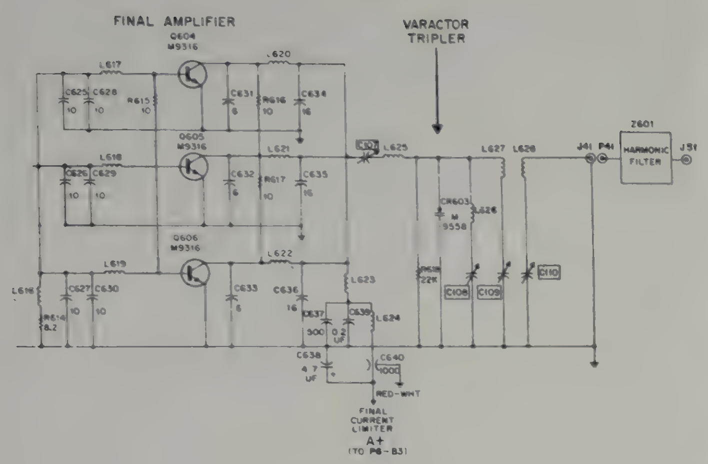
(TOP VIEW)

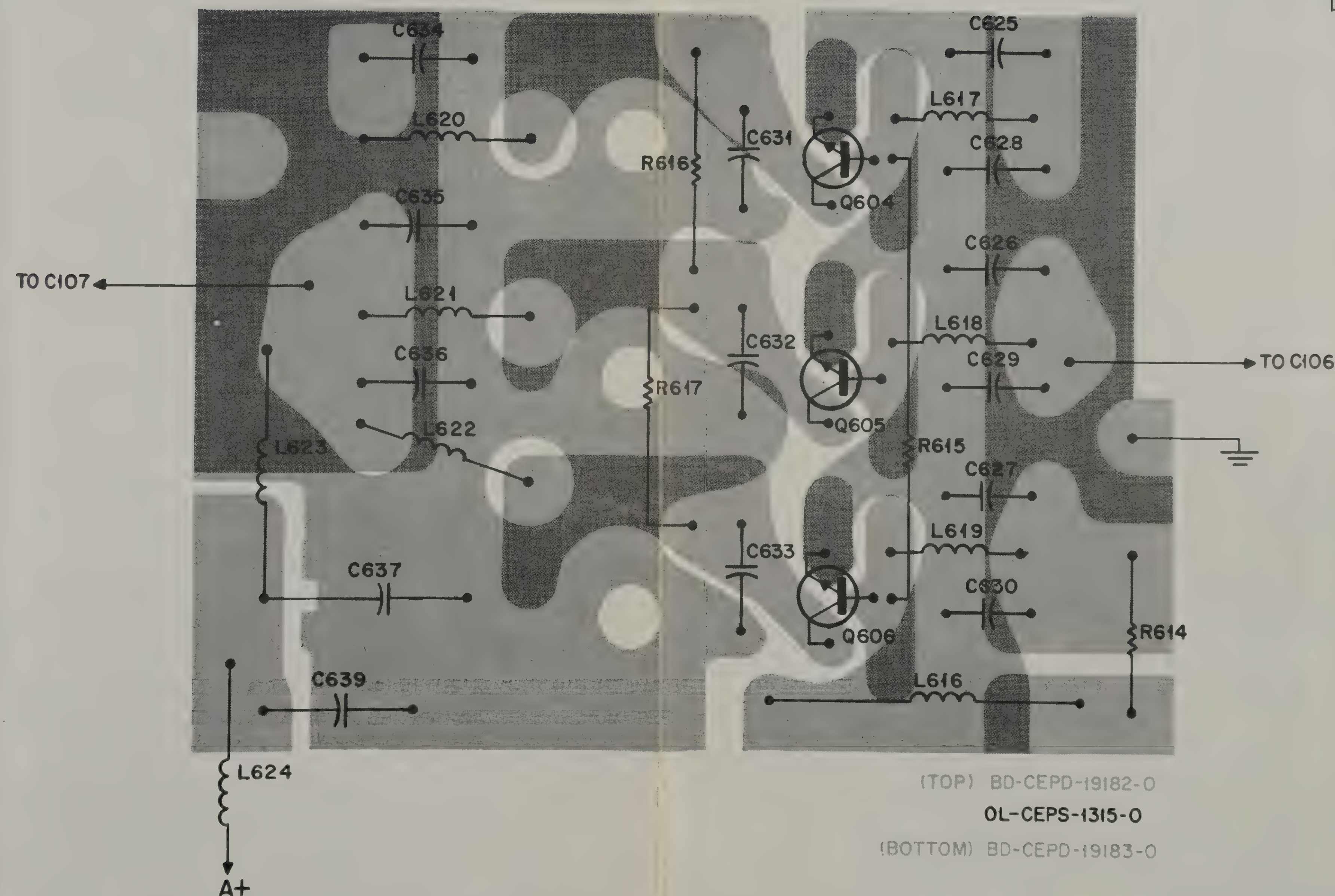
B = BASE
E = EMITTER
C = CATHODE

CODE NUMBER	MOTOROLA PART NO.	DESCRIPTION	QTY.
1	3A82227A02	Screw 4-40 x 7/16"	7
2	3S134269	Tapping Screw, locking plain hex	6
3	3S134169	Screw 4-40 x 1/4"	17
4	3S134186	Screw 6-32 x 5/16" "Phillips" hex	3
5	3S135049	Screw 10-32 x 3/8" Plain hex	4
6	26D83027D01	Heat Sink	1
7	42A881156	Cable Clamp	2
8	2S8370	Nut 10-32 x 3/8" hex	6
9	64B84084B01	Heat Sink	1
10	64B83197D01	Heat Sink	1
11	15B84006A01	Exciter Board Cover	1
12	15B83036H01	Cable Cover	1
13	3S135839	Screw 6-32, locking plain hex	5
14	3S134136	Tapping Screw 6-32 x 5/16" "Phillips" hex locking	4
15	1V80781A44	Varactor Housing Assy	1
16	15C83005H01	Rear Cover	1
17	41A82114E01	Channel Element Clip	1 to 4
18	64B83007H01	Varactor Cover	1



AEPS-1431-O





REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

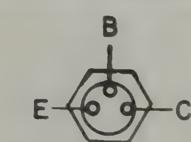
1V80701B35 Power Amplifier (P/O TLE6512A) PL-676-O

		CAPACITOR fixed: pF; 500 V; unl. stated
C625 thru 630	21D82355B26	10 ±0.25 pF; NPO
C631 thru 633	21D82204B03	6 ±0.5 pF; NPO
C634 thru 636	21K848525	16 ±5%; NPO
C637	21D82880E19	500 ±10%
C639	21C82372C05	0.2 uF +80-20%; 25 V
		COIL, RF:
L616	24V80900A86	choke; 1.02 uH; sleeved; code BRN, V10
L617 thru 619	24B83656E01	1 turn
L620 thru 622	24B83656E02	2 turns
L623	24C82000E26	choke; sleeved; coded ORG
L624	24C82000E25	choke; sleeved; coded BLU
		TRANSISTOR, N-P-N: (SEE NOTE)
Q604 thru 606	48R869316	type M9316; does not incl. 14A83211B01 INSULATOR mtg.
		RESISTOR, fixed:
R614	6S124B67	8.2 ±5%; 1/4 W
R615 thru 617	6S5621	10 ±10%; 1/2 W

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.

TRANSISTOR DETAIL

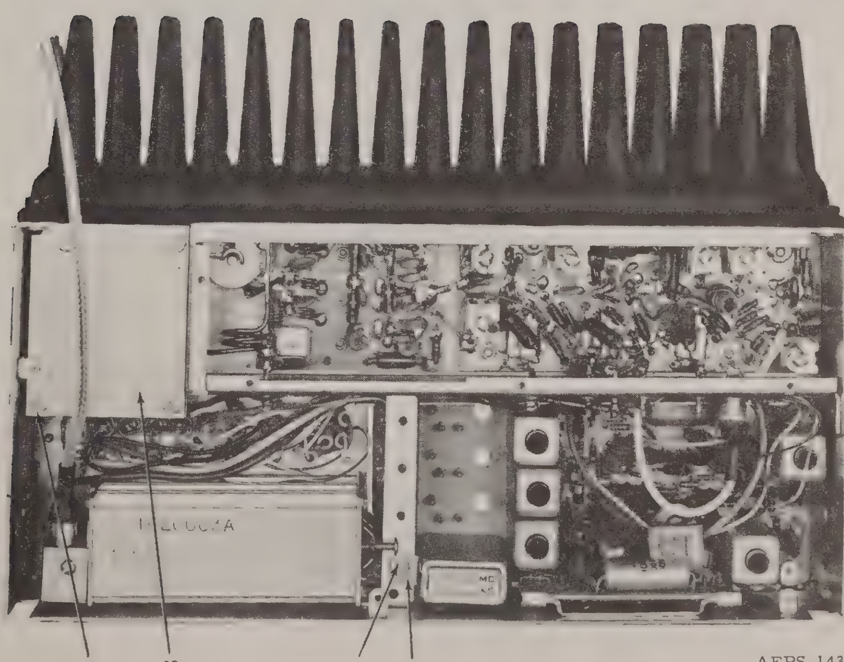


(TOP VIEW)

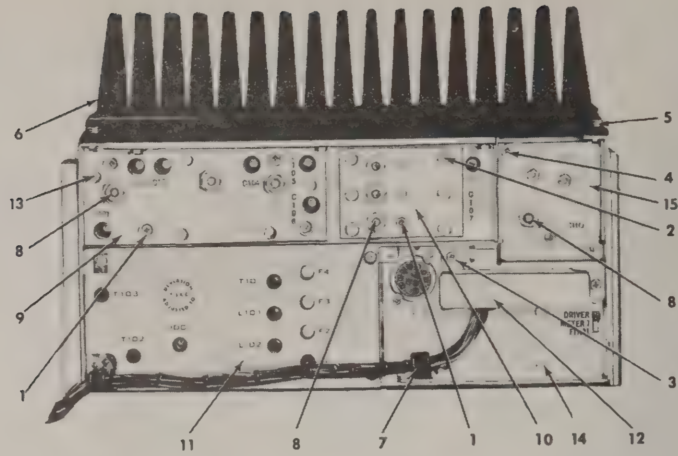
B = BASE
E = EMITTER
C = CATHODE

1V80701B35 Power Amplifier
Circuit Board Detail
Motorola No. PEPS-1316-B
7/10/70-UP

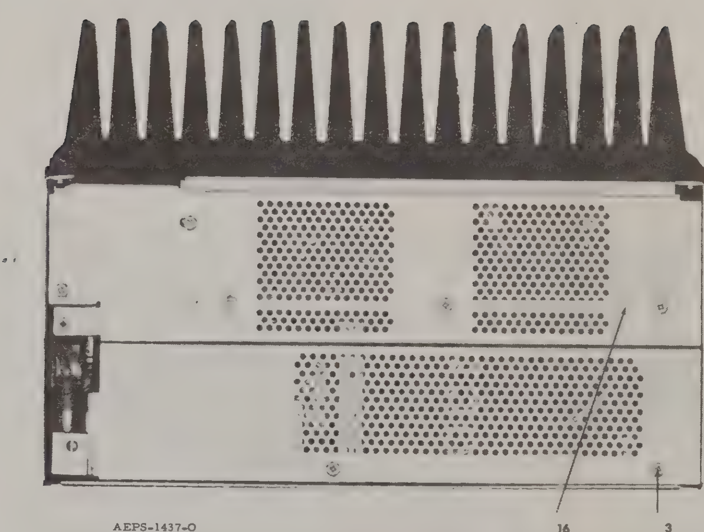
CODE NUMBER	MOTOROLA PART NO.	DESCRIPTION	QTY.
1	3A82227A02	Screw 4-40 x 7/16"	7
2	3S134269	Tapping Screw, locking plain hex	6
3	3S134169	Screw 4-40 x 1/4"	17
4	3S134186	Screw 6-32 x 5/16" "Phillips" hex	3
5	3S135049	Screw 10-32 x 3/8" Plain hex	4
6	26D83027D01	Heat Sink	1
7	42A881156	Cable Clamp	2
8	2S8370	Nut 10-32 x 3/8" hex	6
9	64B84084B01	Heat Sink	1
10	64B83197D01	Heat Sink	1
11	15B84006A01	Exciter Board Cover	1
12	15B83036H01	Cable Cover	1
13	3S135839	Screw 6-32, locking plain hex	5
14	3S134136	Tapping Screw 6-32 x 5/16" "Phillips" hex locking	4
15	1V80781A44	Varactor Housing Assy	1
16	15C83005H01	Rear Cover	1
17	41A82114E01	Channel Element Clip	1 to 4
18	64B83007H01	Varactor Cover	1



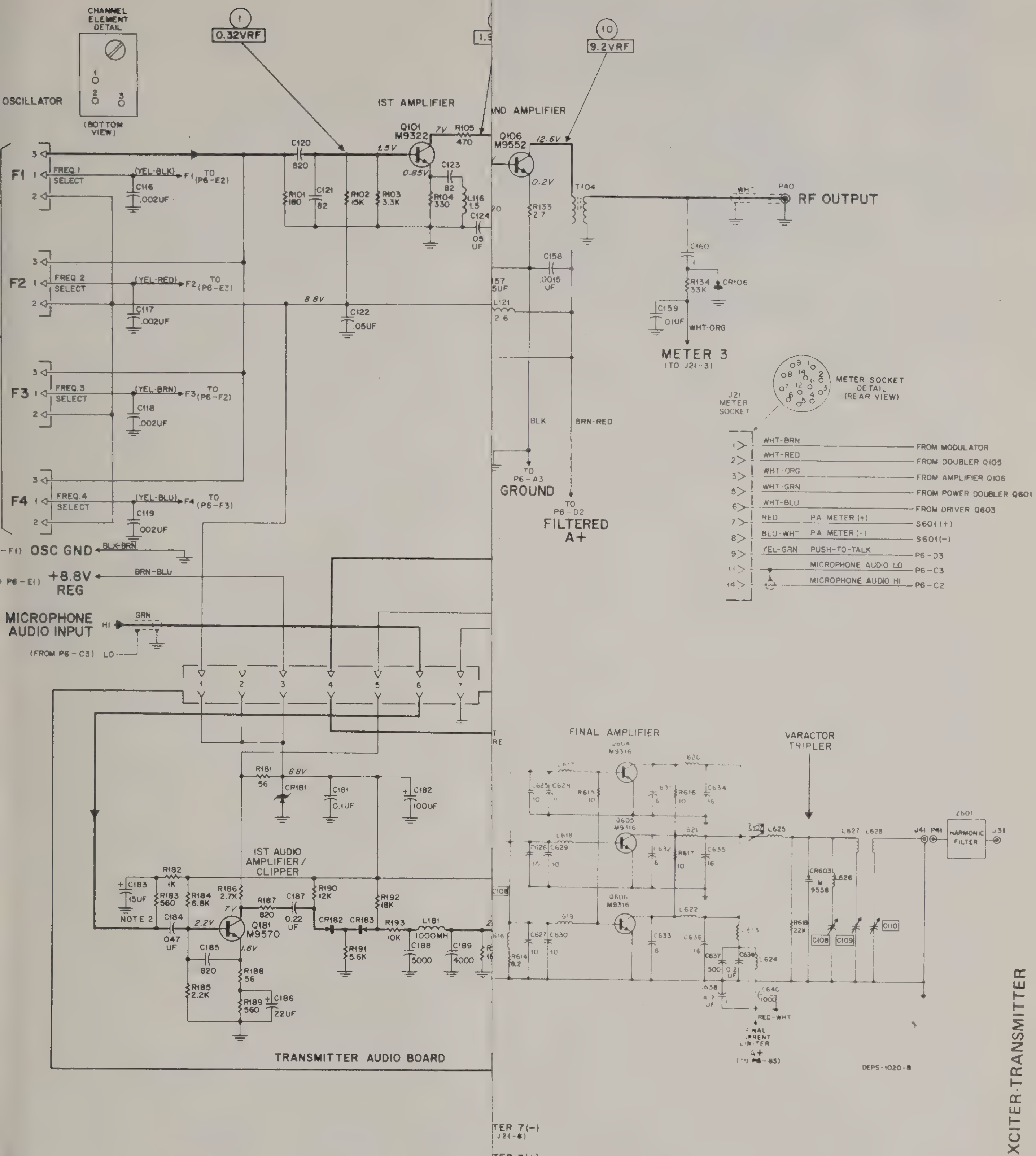
AEPS-1431-O



AEPS-1430-A



AEPS-1437-O



TES.

UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS (K = 1000). CAPACITOR VALUES ARE IN PICOFARADS. INDUCTOR VALUES ARE IN MICROHENRIES.

R183 USED ONLY IN LOCAL CONTROL MODELS WITHOUT MONITOR INTERCOM OPTION.

COMPONENT REFERENCES WITHIN RECTANGLES ARE MARKED ON THE EQUIPMENT.

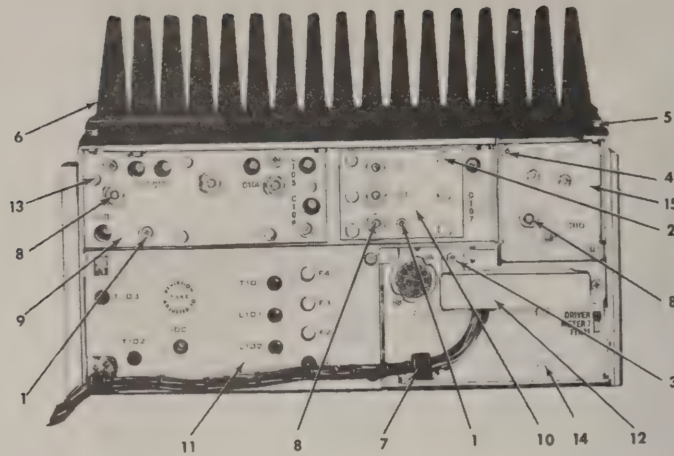
ALL DC VOLTAGES ARE MEASURED WITH A MOTOROLA TRANSISTORIZED DC MULTIMETER OR EQUIVALENT WITH 11 MEGOHMS INPUT RESISTANCE. VOLTAGES SHOWN ARE WITH TRANSMITTER IN KEYED POSITION.

Move

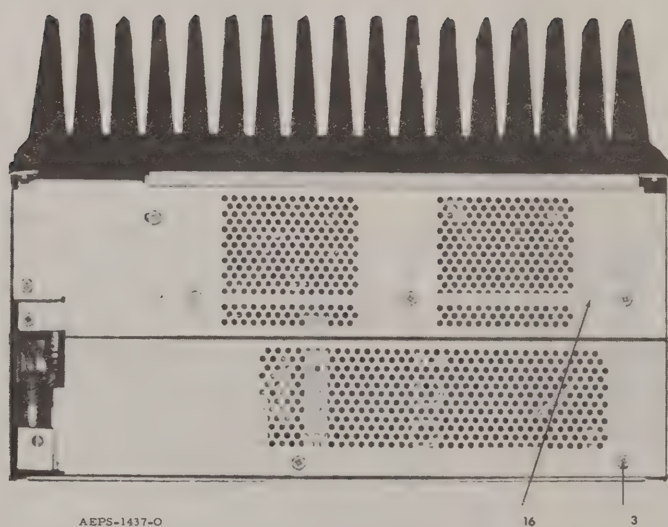
EPD-21324-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRA...

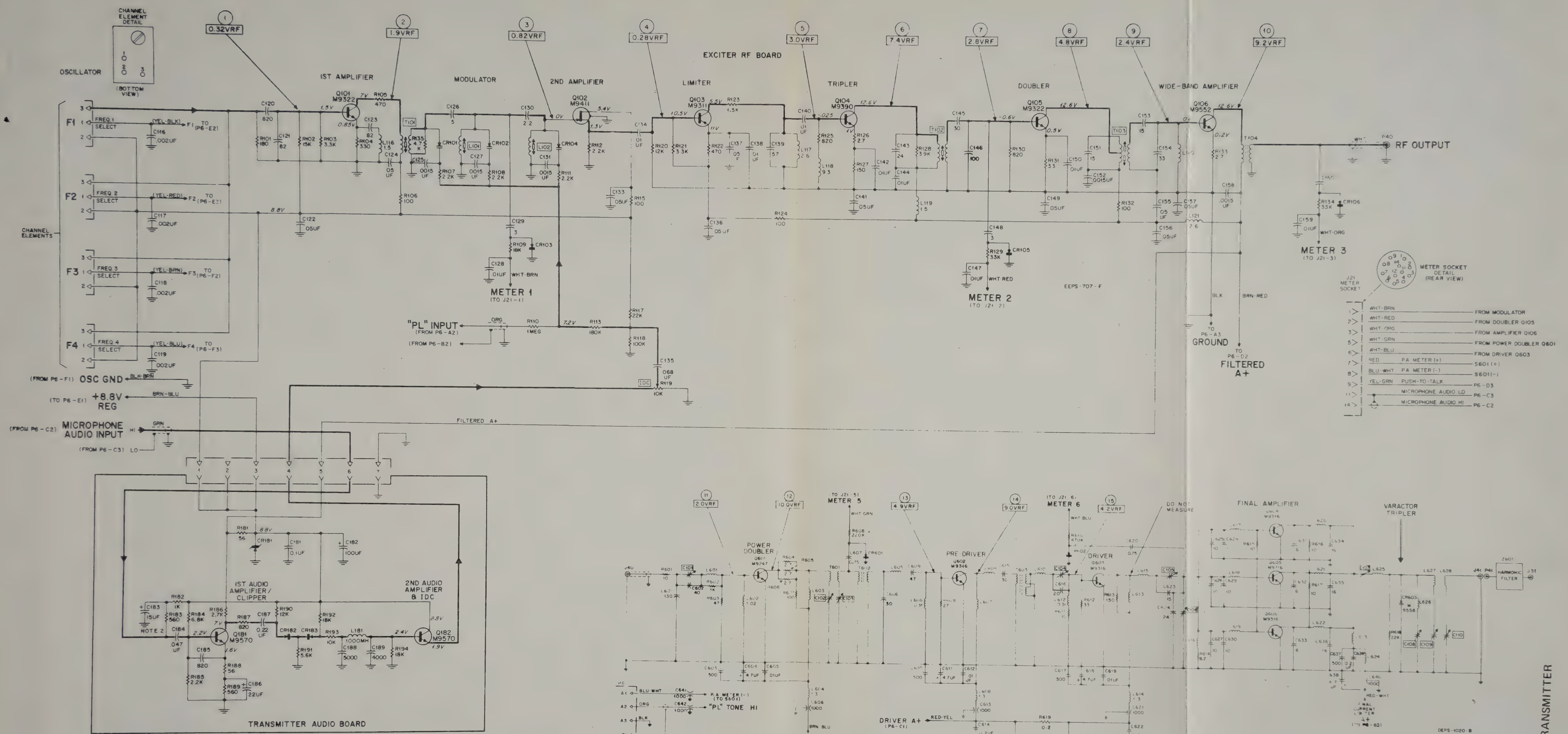
Exciter-Transmitter
Schematic Diagram
Motorola No. 63P81057A02-H
3/22/72-UP

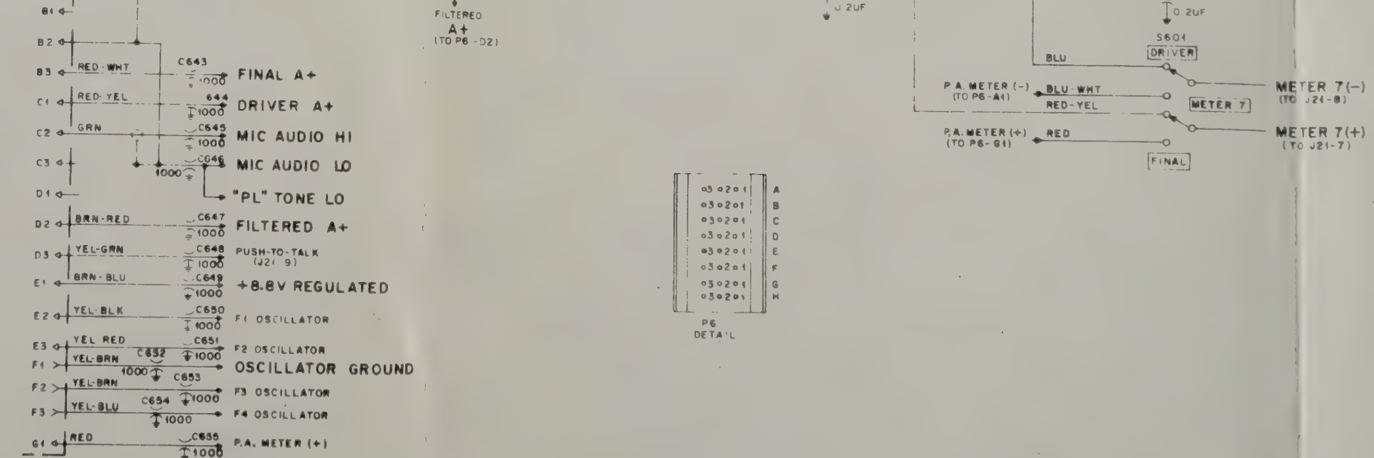


AEPS-1430-A



AEPS-1437-O





NOTES:

1. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS (K = 1000). CAPACITOR VALUES ARE IN PICOFARADS. INDUCTOR VALUES ARE IN MICROHENRIES.
2. R183 USED ONLY IN LOCAL CONTROL MODELS WITHOUT MONITOR INTERCOM OPTION.
3. COMPONENT REFERENCES WITHIN RECTANGLES ARE MARKED ON THE EQUIPMENT.
4. ALL DC VOLTAGES ARE MEASURED WITH A MOTOROLA TRANSISTORIZED DC MULTIMETER OR EQUIVALENT WITH 11 MEGOHMS INPUT RESISTANCE. VOLTAGES SHOWN ARE WITH TRANSMITTER IN KEYED POSITION.

Move

EPD-21324-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRA...

Exciter-Transmitter
Schematic Diagram
Motorola No. 63P81057A02-H
3/22/72-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TLE6512A Transmitter Chassis Kit		PL-660-B
		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C107	19C83221D01	var: 2.93-13.5; 850 V peak
C108, 109	19C83444C04	var: 1.3-5.2; 1100 V peak
C110	19C83444C02	var: 1.74-6.57; 750 V peak
C606, 613 621, 640 thru 655	21K861219	feed-thru type; 1000 +100-0%; coded RED
C614, 622	21C82372C05	0.2 uF +80-20%; 25 V
C638	23K865137	4.7 uF ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR601, 602	48C82139G01	germanium
CR603	48R869558	silicon; varactor; type M9558
		CONNECTOR, receptacle:
J21	9C83478E01	female; 12-contact
J40	9B82323G01	female; min; coaxial
J41	9C83663C01	female; min; coaxial
		COIL, RF:
L625	24C84095A01	2 turns
L626	24A83450C01	2 turns
L627	24A83002H01	1/2 turn
L628	24A83003H01	1/2 turn
		CONNECTOR, plug:
P6		includes: 14C82337A09 BODY: 24-contact type; 29C82335A01 TERMINAL, contact male; 29C82336A01 TERMINAL, contact female; 29C82335A02 TERMINAL, contact: male (specify quantity); 29C82336A02 TERMINAL, contact: female (specify); 15D83934A01 SHELL
		RESISTOR, fixed: 1/4 W unl. stated
R608	6S124B06	220K ±5%
R610	6S129149	470K ±5%
R618	6S128685	22K ±10%
R619	17C82586H01	0.2; ±5%; 5 W
		SWITCH, slide:
S601	40B83204B01	dpdt
	NON-REFERENCED ITEMS	
	64B83007H01	COVER
	15B84006A03	COVER, exciter: includes legend

Harmonic Filter PL-371-O

	TFE6003A	FILTER, RF 450-460 MHz
	or TFE6004A	FILTER, RF 460-470 MHz

Channel Element PL-658-O

	TLN1190A	Transmitter control

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

"IDC" ADJUSTMENT

1. INTRODUCTION

Accuracy of test equipment is of prime importance to any user of radio communications equipment; but of equal importance is a knowledge of the characteristics of the measuring equipment under various conditions.

The Motorola S1079A Deviation Monitor/Frequency Synthesizer (used with the high resolution S1075B Digital Frequency Meter to constitute Model S1078A) provides a highly accurate means of measuring frequency deviation directly from the rf output of the transmitter. The peak-reading deviation meter used in this unit has the high sensitivity necessary for measuring the low deviation of split-channel transmitters.

2. PROCEDURE WITH PEAK-READING DEVIATION MONITOR

a. Test Equipment Required

(1) Motorola S1078A Digital Frequency Meter with Deviation Monitor/Frequency Synthesizer.

(2) Motorola Transistorized AC Voltmeter (or equivalent).

(3) Motorola Model TEK-1A Transistorized Tone Generator.

b. Setting Up Test Equipment

(1) To monitor transmissions for deviation adjustment, the antenna provided with the Digital Frequency Meter should be connected to the ANTENNA input of the Deviation Monitor/Frequency Synthesizer and placed within a few feet of the transmitter.

(2) Place the function switch on the Deviation Monitor/Frequency Synthesizer in the SET OSC. position.

(3) Set the local oscillator 500 kHz above or below the assigned carrier frequency of the transmitter. The frequency of the local oscillator will appear on the digital readout.

(4) Place the function switch in the LIMITER 500 KC OUT position. Key the transmitter and observe the limiter reading on the front panel meter. If the meter pointer is above the red markings at 6/3 kHz, the antenna input is adequate.

(5) Move the function switch to ZERO SET and zero the front panel meter.

(6) To measure deviation, set the function switch to the appropriate (8 KC or 1.6 KC) position. When in the 1.6 KC position, the transmitter should remain keyed to prevent noise from pinning the meter.

c. Measurement and Setting of Transmitter Deviation

(1) Key the transmitter with no audio input and check "Private-Line" tone deviation ("Private-Line" models only). The tone deviation reading should be 0.5 to 1 kHz.

(2) Apply a 1-volt, 1000 Hz input signal to terminals 2 and 3 on the top terminal strip (TB1) at the rear of the junction box.

(3) With this input signal level, adjust the IDC control (R119) on the transmitter to provide a deviation reading of ±5 kHz on the deviation meter.

REVISIONS

63P81057A02-H

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
TLE6392A	Q104 R123 R125 R126	WAS TYPE M9322 WAS 1.2K; ±5%; 1/4 W WAS 330; ±5%; 1/4 W WAS 3.3; ±5%; 1/4 W	EXCITER RF BOARD	PEPS-714
TLE6392A-1 TTE1170AA TTE1133AA TTE1134AA		CONTAINED TLE6412A TRANSMITTER CHASSIS KIT WHICH INCLUDED 1V80701B33 DOUBLER-DRIVER CIRCUIT BD.	Q602 AND METER 7 CIRCUITS	PEPS-1319
TTE1170AA-1 TTE1133AA-1 TTE1134AA-1		CHANGED TO TLE6512A TRANSMITTER CHASSIS KIT AND TLN4220A DOUBLER-DRIVER CIRCUIT BOARD		PEPS-2593
TLE6392A-2	R135	ADDED	T101 SECONDARY	PEPS-714
TLE6392A-3		REVISED PRINTED CIRCUIT BOARD PLATING		PEPS-3621-C
TLE6392A-4				PEPS-3621-D

PARTS LIST

TLE6412A Transmitter Chassis Kit PL-370-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C107	19C83221D01	var: 2.93-13.5; 850 V peak
C108, 109	19C83444C04	var: 1.3-5.2; 1100 V peak
C110	19C83444C02	var: 1.74-6.57; 750 V peak
C606, 613 621, 640 thru 655	21K861219	feed-thru type; 1000 +100-0%; coded RED
C614, 622	21C82372C05	0.2 uF +80-20%; 25 V
C638	23K865137	4.7 uF ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR601, 602	48C82139G01	germanium
CR603	48R869558	silicon; varactor; type M9558
		CONNECTOR, receptacle:
J21	9C857358	female; 12-contact
J40	9B82323G01	female; min; coaxial
J41	9C83663C01	female; min; coaxial
		COIL, RF:
L611	24K832590	choke; 1.3 uH
L625	24C84095A01	2 turns
L626	24A83450C01	2 turns
L627	24A83002H01	1/2 turn
L628	24A83003H01	1/2 turn
		CONNECTOR, plug:
P6		c/o: 14C82337A09 BODY: 24-contact type 29C82335A02 TERMINAL, contact: male (specify quantity) 29C82336A02 TERMINAL, contact: female (specify) 15D83934A01 SHELL
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R608	6S124B06	220K ±5%
R610	6S129149	470K ±5%
R618	6S128685	22K

TLE6512A Transmitter Chassis Kit PL-660-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C107	19C83221D01	var: 2.93-13.5; 850 V peak
C108, 109	19C83444C04	var: 1.3-5.2; 1100 V peak
C110	19C83444C02	var: 1.74-6.57; 750 V peak
C606, 613 621, 640 thru 655	21K861219	feed-thru type; 1000 +100-0%; coded RED
C614, 622	21C82372C05	0.2 uF +80-20%; 25 V
C638	23K865137	4.7 uF ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR601, 602	48C82139G01	germanium
CR603	48R869558	silicon; varactor; type M9558
		CONNECTOR, receptacle:
J21	9C83478E01	female; 12-contact
J40	9B82323G01	female; min; coaxial
J41	9C83663C01	female; min; coaxial
		COIL, RF:
L625	24C84095A01	2 turns
L626	24A83450C01	2 turns
L627	24A83002H01	1/2 turn
L628	24A83003H01	1/2 turn
		CONNECTOR, plug:
P6		includes: 14C82337A09 BODY: 24-contact type; 29C82335A01 TERMINAL, contact male; 29C82336A01 TERMINAL, contact female; 29C82335A02 TERMINAL, contact: male (specify quantity); 29C82336A02 TERMINAL, contact: female (specify); 15D83934A01 SHELL
		RESISTOR, fixed: 1/4 W unl. stated
R608	6S124B06	220K ±5%
R610	6S129149	470K ±5%
R618	6S128685	22K ±10%
R619	17C82586H01	0.2; ±5%; 5 W
		SWITCH, slide:
S601	40B83204B01	dpdt
	NON-REFERENCED ITEMS	
	64B83007H01	COVER
	15B84006A03	COVER, exciter: includes legend

Harmonic Filter PL-371-O

	TFE6003A or TFE6004A	FILTER, RF 450-460 MHz FILTER, RF 460-470 MHz

Channel Element PL-658-O

	TLN1190A	Transmitter control

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

"IDC" ADJUSTMENT

1. INTRODUCTION

Accuracy of test equipment is of prime importance to any user of radio communications equipment; but of equal importance is a knowledge of the characteristics of the measuring equipment under various conditions.

The Motorola S1079A Deviation Monitor/Frequency Synthesizer (used with the high resolution S1075B Digital Frequency Meter to constitute Model S1078A) provides a highly accurate means of measuring frequency deviation directly from the rf output of the transmitter. The peak-reading deviation meter used in this unit has the high sensitivity necessary for measuring the low deviation of split-channel transmitters.

2. PROCEDURE WITH PEAK-READING DEVIATION MONITOR

a. Test Equipment Required

(1) Motorola S1078A Digital Frequency Meter with Deviation Monitor/Frequency Synthesizer.

(2) Motorola Transistorized AC Voltmeter (or equivalent).

(3) Motorola Model TEK-1A Transistorized Tone Generator.

b. Setting Up Test Equipment

(1) To monitor transmissions for deviation adjustment, the antenna provided with the Digital Frequency Meter should be connected to the ANTENNA input of the Deviation Monitor/Frequency Synthesizer and placed within a few feet of the transmitter.

(2) Place the function switch on the Deviation Monitor/Frequency Synthesizer in the SET OSC. position.

(3) Set the local oscillator 500 kHz above or below the assigned carrier frequency of the transmitter. The frequency of the local oscillator will appear on the digital readout.

(4) Place the function switch in the LIMITER 500 KC OUT position. Key the transmitter and observe the limiter reading on the front panel meter. If the meter pointer is above the red markings at 6/3 kHz, the antenna input is adequate.

(5) Move the function switch to ZERO SET and zero the front panel meter.

(6) To measure deviation, set the function switch to the appropriate (8 KC or 1.6 KC) position. When in the 1.6 KC position, the transmitter should remain keyed to prevent noise from pinning the meter.

c. Measurement and Setting of Transmitter Deviation

(1) Key the transmitter with no audio input and check "Private-Line" tone deviation ("Private-Line" models only). The tone deviation reading should be 0.5 to 1 kHz.

(2) Apply a 1-volt, 1000 Hz input signal to terminals 2 and 3 on the top terminal strip (TB1) at the rear of the junction box.

(3) With this input signal level, adjust the IDC control (R119) on the transmitter to provide a deviation reading of ±5 kHz on the deviation meter.

(4) Reduce the 1000 Hz input signal to obtain a deviation reading of 3.3 kHz on the meter. The 1000 Hz signal level necessary to obtain the 3.3 kHz 2/3 deviation should be 0.165 (±.070) volt for optimum performance. A higher reading could indicate a weak audio stage.

3. EMERGENCY MEASUREMENT OF DEVIATION

If an audio oscillator is not available, a loud sustained whistle of approximately 1000 cycles can be used for a rough measurement of deviation. If this rough check indicates the need for resetting deviation, do so only under controlled conditions, using a 1000 Hz tone as previously indicated.

4. OTHER MEANS FOR MEASUREMENT OF DEVIATION

Another accurate means of measuring transmitter deviation is to use the Motorola T1021B Frequency Meter and the Motorola S1058A or S1059A Test Set (with deviation meter) for measuring deviation. These units, properly used, permit the accurate measurement and setting of transmitter deviation from a peak-reading meter, which is unaffected by waveform. With these devices, the transmitter deviation can be measured accurately even with voice modulation.

5. DEVIATION CONSIDERATIONS

The foregoing procedures will insure that the transmitter will comply with FCC requirements for maximum deviation.

The importance of the correct deviation setting cannot be overemphasized. Optimum system performance demands accurate deviation setting, both from the standpoint that overdeviation will interfere with the user on the adjacent channel, and underdeviation may reduce system range.

TRANSMITTER PRE-ALIGNMENT NOTES

A. EXCERPTS FROM FCC REGULATIONS

FCC Regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.
2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and the local conditions.
3. Frequency and deviation of a transmitter must be checked before it is placed in service and rechecked once each year thereafter.

B. TEST EQUIPMENT REQUIRED

1. Built-in metering facilities or Motorola Model S1056A-9A Portable Test Set with a Motorola Model TKN6025A Adapter Cable (available on separate order). A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.
2. Motorola Model TLN8805A Tuning Tool Kit.
3. Motorola Model T1013A RF Load Resistor (or equivalent) and Model 43 Bird "Thruline" Wattmeter with 100-watt element (or equivalent).
4. Digital Frequency Meter S1075B or Digital Frequency Meter and Deviation Monitor S1078B.

C. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to XMTR position.
2. Place the oscillator and meter reversing switch in the OFF position.
3. Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the transmitter metering socket. When the test set is not being used, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.

D. HOW TO KEY THE TRANSMITTER

1. Connect the load resistor and "Thruline" wattmeter to the exciter-transmitter output.
2. Key the transmitter with the microphone push-to-talk switch or the KEY XMTR switch on the test set.

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Current is excessive in untuned stages and may cause damage. Turn on the transmitter for brief periods while reading the meter and then make the adjustments.

E. FREQUENCY CALCULATIONS

xtal freq. in MHz $\longrightarrow f_o \qquad \frac{f_c}{36} \longleftarrow$ carrier freq. in MHz

F. "IDC" CONTROL SETTING
(Transmitter Deviation)

Refer to the separate IDC Adjustment Procedure for setting of the IDC control.

G. PRE-ALIGNMENT STATION SWITCH POSITION CHART

CHASSIS	CONTROL	POSITION
RF Power Amplifier	HIGH VOLTAGE SWITCH	Off
	SCREEN VOLTAGE	Fully Counterclockwise
	PLATE TUNING SCREW	Fully Clockwise
	GRID TUNING KNOB	Fully Counterclockwise

H. TRANSMITTER ALIGNMENT PROCEDURE

NOTE

This tuning procedure must be followed exactly whenever tuning is required. When the power amplifier tube is replaced, set station switch to positions as given in the Pre-Alignment Station Switch Position Chart and follow steps 25 through 37 only.

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
1	PA High Voltage Switch and exciter METER 7 switch	None	Turn power amplifier high voltage switch off. Output cable from exciter-transmitter must be connected to wattmeter and load, not to power amplifier. Reclamp the tube per Step 7 in the Power Amplifier Tube Removal Procedure. (Refer to Service Aids in the Power Amplifier Section.) Place the METER 7 switch on the exciter in the FINAL position if exciter is equipped with this switch.
2	C109, C108, C102, C106	None	Using blade end of tuning tool A, turn C108 and C109 counterclockwise to stop. Use screwdriver end of tuning tool B; turn C102 and C106 counterclockwise to stop.
3	T101, L101, L102, T102	None	Use hex end of tuning tool B. Slugs should be set at lower end ("printed circuit board end") of coil form.
4	T103 Primary	None	Use hex end of tuning tool B. Lower tuning slug should be set at lower end of coilform near printed circuit board.
5	T103 Secondary	None	Use hex end of tuning tool A. Upper tuning slug should be set at upper end of coil form near top of can.
6	---	None	OSCILLATOR - FCC regulations require a periodic frequency check. If the check is due at this time, follow the IDC Adjustment Procedure; OTHERWISE NO ADJUSTMENT SHOULD BE MADE.
7	---	None	Select lowest operating frequency.
8	T101, L101	1	FIRST AMPLIFIER OUTPUT - MODULATOR - Use hex end of tuning tool. Tune T101, L101, T101 in that order for maximum reading. Only a small meter indication (approximately .5 ua) will be observed when tuning T101. Choose first peak for tuning (slug nearest printed circuit board).
9	L102	1	2ND AMPLIFIER INPUT - Use hex end of tuning tool. Tune for minimum reading. Choose first dip (slug nearest printed circuit board).
10	L102	2	TRIPLER OUTPUT - Use hex end of tuning tool. Tune for maximum reading. Slug should be approximately in center of coil form.
11	T103 Primary	2	DOUBLER OUTPUT - Use hex end of tuning tool. Tune for minimum reading. Choose first dip (slug nearest printed circuit board).

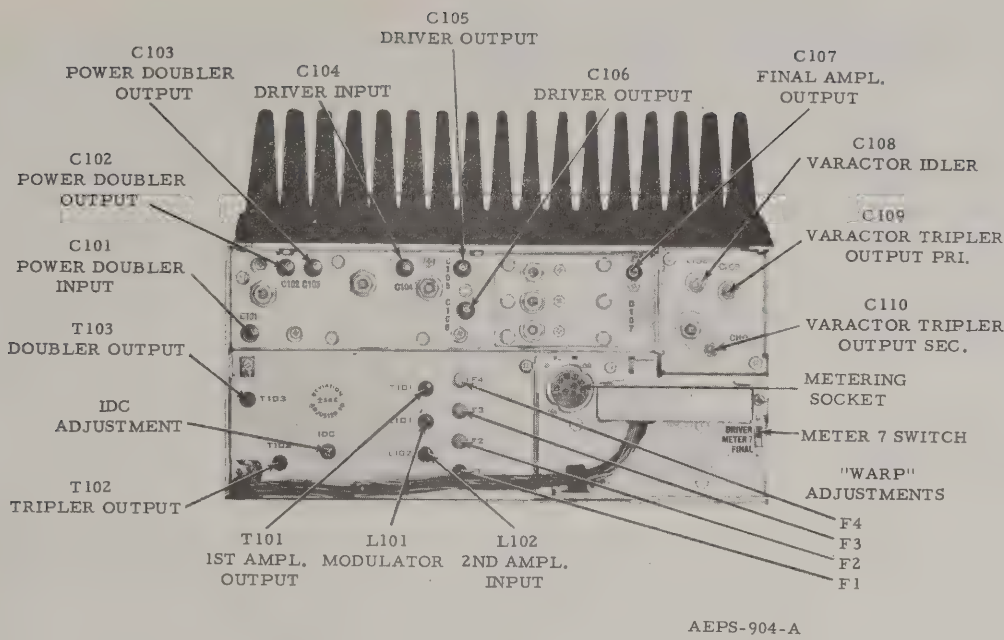


Figure 1.
Exciter-Transmitter Alignment Detail

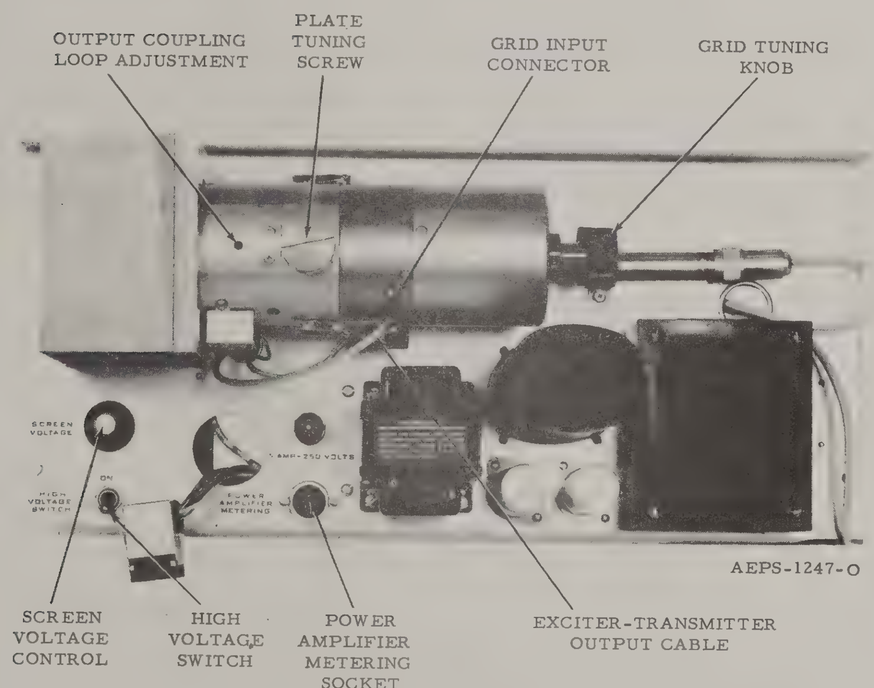


Figure 2.
Power Amplifier Alignment Detail

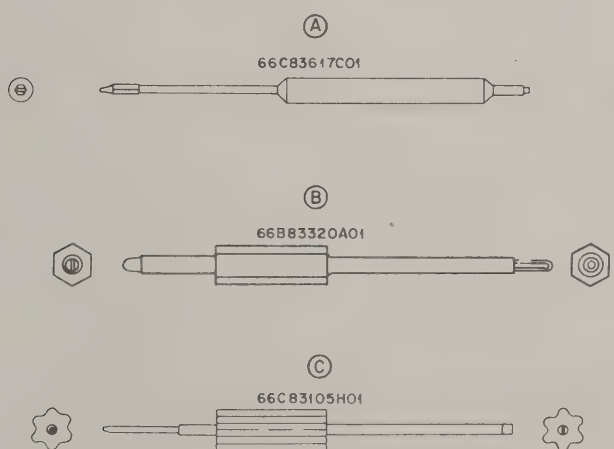
H. TRANSMITTER ALIGNMENT PROCEDURE (CONT'D)

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
12	T103 Secondary	3	DOUBLER OUTPUT - Use hex end of tuning tool A. Tune for maximum reading. Choose first peak (slug farthest from printed circuit board).
13	T103 Primary	3	DOUBLER OUTPUT - Use hex end of tuning tool. Tune for maximum reading.
14	C103, C101	5	POWER DOUBLER OUTPUT & INPUT - Use screwdriver end of tuning tool. Tune C103 and C101 in that order, for maximum reading.
15	C103, C102	5	POWER DOUBLER OUTPUT - Use screwdriver end of tuning tool. Tune C103 and C102 (turning C102 clockwise) in that order for a maximum reading. Repeak C103 and C102 in that order for maximum reading.
16	C105, C106	6	DRIVER OUTPUT - Use screwdriver end of tuning tool. Tune C105 and C106 in that order for maximum reading. (Turning C106 clockwise.) If at any time while tuning, a meter reading drops abruptly, due to the current limiter protection circuits, it may be necessary to rekey the transmitter while varying the tuning control.
17	C104	6	DRIVER INPUT - Use screwdriver end of tuning tool. Tune C104 for a minimum reading without being an abrupt dip.
18	C107	PA	FINAL AMPLIFIER OUTPUT - Use screwdriver end of tuning tool. Tune for minimum reading without being an abrupt dip.
19	C109	Wattmeter	VARACTOR TRIPLER OUTPUT PRIMARY - Using tuning tool A, turn C109 clockwise for maximum reading.
20	C110	Wattmeter	VARACTOR TRIPLER OUTPUT SECONDARY - Tune for maximum reading.
21	C104, C105, C106, C107	Wattmeter	Tune C104, C105, C106 and C107 in that order for maximum reading.
22	C109	Wattmeter	Tune for maximum reading.
23	C108	Wattmeter	VARACTOR IDLER - Rotate C108 fully clockwise and return counterclockwise for a maximum reading.
24	---	---	Remove metering plug from exciter-transmitter metering socket, and plug it into the power amplifier metering socket. Connect exciter-transmitter output cable to the power amplifier grid. (See Figure 2.) Connect wattmeter to the power amplifier output. Use a 5-1/2" cable to connect the wattmeter to the power amplifier.
25	PA Grid Tuning Knob	6 on PA	Tune the PA grid tuning knob for maximum reading with high voltage switch OFF.
26	Plate Tuning Screw	Wattmeter	Turn the high voltage switch to the "on" position and turn the plate tuning screw for a maximum reading.
27	Output Coupling Loop	Wattmeter	CAUTION: DO NOT INSERT METAL SCREWDRIVER INTO OUTPUT COUPLING LOOP HOLE. Insert the longer screwdriver end of tuning tool C into the plate cavity and adjust the output coupling loop for a maximum reading.

H. TRANSMITTER ALIGNMENT PROCEDURE (CONT'D)

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
28	Screen Voltage	PA	Turn the screen voltage control clockwise until PA meter reads 25 ua.
29	Grid Tuning Knob, Plate Tuning Screw, Output Coupling Loop	Wattmeter	Alternately tune the Grid Tuning Knob, the Plate Tuning Screw, and the Output Coupling Loop, in that order, for a maximum reading. Repeat until power output does not increase with retuning.
30	Screen Voltage	PA B+	Note the plate voltage (B+ meter). Increase or decrease the screen voltage until (PA Meter reading) x 10,000 = Table 1 value of I_p.
31	Screen Voltage	PA B+	If the plate voltage has changed from that noted in Step 30, repeat Step 30 using the new value of plate voltage.
32			Repeat Steps 29, 30 and 31.
33	C110, C109, C108, C107	6 on PA	Tune C110, C109, C108 and C107 in that order on the exciter-transmitter for maximum reading.
34	C107	PA (METER 7 switch in FINAL)	Replace metering cable in exciter-transmitter metering socket. Turn C107 such that PA meter READING DECREASES 3 ua from the initial reading. If after reducing current 3 ua, current is still greater than 40 ua, reduce to 40 ua.
35	T103	3	Use hex end of tuning tool. Tune primary and secondary slugs for maximum reading.
36	C106	PA (METER 7 switch in DRIVER)	If exciter has a METER 7 switch, place in DRIVER position. If meter reads above 15 ua, turn C106 counterclockwise for a 15 ua reading.
37	Grid Tuning Knob	Wattmeter	Adjust grid tuning knob for maximum power output.

TRANSMITTER ALIGNMENT TOOLS



BEPS-1373-0

TABLE 1.
POWER INPUT

*180 WATT DC POWER INPUT
(For 90-Watt Models)

PLATE VOLTAGE (B+ Meter)	PLATE CURRENT (PA Meter 7 x 10, 000)
500 V	200 mA
525 V	215 mA
550 V	225 mA
575 V	235 mA
600 V	250 mA
625 V	260 mA
650 V	278 mA
675 V	262 mA
700 V	257 mA
725 V	250 mA
750 V	240 mA
775 V	232 mA
800 V	225 mA
825 V	218 mA
850 V	212 mA
875 V	206 mA
900 V	200 mA

120 WATT DC POWER INPUT
(For 60-Watt Models)

PLATE VOLTAGE	PLATE CURRENT (PA Meter 7 x 10, 000)
440 V	272 mA
460 V	261 mA
480 V	250 mA
500 V	240 mA
520 V	230 mA
540 V	222 mA
560 V	214 mA

*Note: When the line voltage to the station is 120 V ac or greater, the standard dc plate input power (180 watts) is used as the E_p, I_p product ($E_p \times I_p$ = 180 W). When the line voltage is below nominal during tune-up, the TABLE 1 values of E_p, I_p must be used to avoid exceeding maximum plate and screen current specifications during line voltage variations. When aligning the amplifier at plate voltages below 700 volts the power output may be less than 90 watts. The alignment procedur does insure that, at nominal line conditions, 90 watts of output is achieved at 180 watts input.

I. FINAL METER READINGS

1. Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
2. All readings given in the tables below are minimum except FINAL AMPLIFIER CURRENT, DRIVER CURRENT and PA CURRENT which are maximum. DO NOT exceed the value given for the PA current. Multiply the microampere scale reading by 1/10 to obtain actual FINAL AMPLIFIER COLLECTOR current and DRIVER CURRENT in amperes. Multiply the microampere scale reading by 10 to obtain PA current in milliamperes.
3. Readings 1, 2, 3, 5, and 6 in the exciter-transmitter chart are purely relative and do not give actual current or voltage measurement.

EXCITER-TRANSMITTER FINAL METER READINGS
(Test Set cable inserted into J21 on Exciter-Transmitter)

CIRCUIT METERED	Modulator 1st Amp.	Tripler	Doubler	Power Doubler	Driver	Final Amp. Current	Driver Current
SWITCH POSITION	1	2	3	5	6	7	7
METER READING	16	20	20	10	15	40	15

POWER AMPLIFIER FINAL METER READINGS
(Test Set cable inserted into J22 on Power Amplifier)

CIRCUIT METERED	Grid Drive	PA Current
SWITCH POSITION	6	7
METER READING	13	30

J. OSCILLATOR FREQUENCY ADJUSTMENT

1. TEMPERATURE COMPENSATED OSCILLATOR FREQUENCY

The channel element oscillator is pre-adjusted at the factory to operate within ±0.0002% of the assigned channel frequency from -30°C (-22°F) to +60°C (140°F). The reference point is 25°C (77°F) at which the transmitter oscillator frequency is set exactly on the assigned channel frequency. AT TEMPERATURES OTHER THAN 25°C THE OSCILLATOR WILL NOT OPERATE EXACTLY ON THE ASSIGNED FREQUENCY. The Channel Element Oscillator Temperature Correction Curve (Figure 3) gives the frequency offset required for a given channel element at a given temperature.

For example, if the temperature of the channel element is +40°C, an oscillator with a "C" channel element should be warped down 0.6 parts per million (ppm) or 280 Hz from the assigned center frequency; at +10°C it should be warped up 0.3 ppm or 140 Hz from the assigned frequency. The letter of the channel element is stamped on the edge of the housing. The amount of correction required at a given temperature is expressed both in ppm and in Hz (at 460 MHz) on the correction curve. This correction in Hz can be used for any carrier frequency in the 450-470 MHz range. A correction of 280 Hz is expressed in MHz as 280 x 0.000001 = 0.000280 MHz. Thus, if the curve shows that the oscillator should be warped down 0.6 ppm and the assigned frequency is 465.025 MHz, the oscillator should operate at 465.02500 MHz less 0.000279 MHz or 465.02472 MHz. THE OSCILLATOR MUST BE SET ON THE FREQUENCY SPECIFIED BY THE CORRECTION CURVE FOR A GIVEN TEMPERATURE IN ORDER TO BE WITHIN FCC FREQUENCY SPECIFICATIONS OVER THE ENTIRE TEMPERATURE RANGE.

NOTE

The best accuracy in setting frequency is obtained with channel element temperature near 25°C. In any case the frequency should not be adjusted if the temperature of the channel element is not between +10°C (50°F) and +40°C (104°F).

The channel element temperature can be determined by measuring with a surface-type thermometer placed on the rear shield next to the channel element. A sufficient time must be allowed for the module temperature to stabilize after the station cabinet doors are opened. Stabilization of the channel element temperature (as indicated by the thermometer reading remaining constat) will usually take place in 15-30 minutes or less depending on the particular installation. The temperature to use with Figure 3 will be the channel element temperature plus 1°C (or 2°F).

2. CHANNEL ELEMENT OSCILLATOR FREQUENCY ADJUSTMENT

NOTE

DO NOT ADJUST CHANNEL ELEMENT UNTIL PROPER FREQUENCY HAS BEEN DETERMINED AS DESCRIBED IN THE PRECEDING PARAGRAPHS.

a. Connect the heterodyne OUTPUT to the Model S1075B INPUT, using the short coaxial cable provided.
b. Set the heterodyne selector switch to the 405-475 MHz range.
c. Set the frequency meter selector switch to either the 100 Hz or the 10 Hz position. With 10 Hz resolution, the first digit of the frequency readout will not appear on the display.
d. Attach the antenna provided with the frequency meter to the appropriate 405-475 MHz input on the heterodyne unit, depending on the rf output of the transmitter under test.
e. Read the frequency indication displayed on the digital readout. In multi-frequency models, make certain that the frequency selector switch is in the desired pos

f. Adjust the appropriate channel element frequency warp adjustment (see Figure 1) until the Digital Meter reads the proper frequency as determined in the preceding explanation of the temperature compensated oscillator frequency.

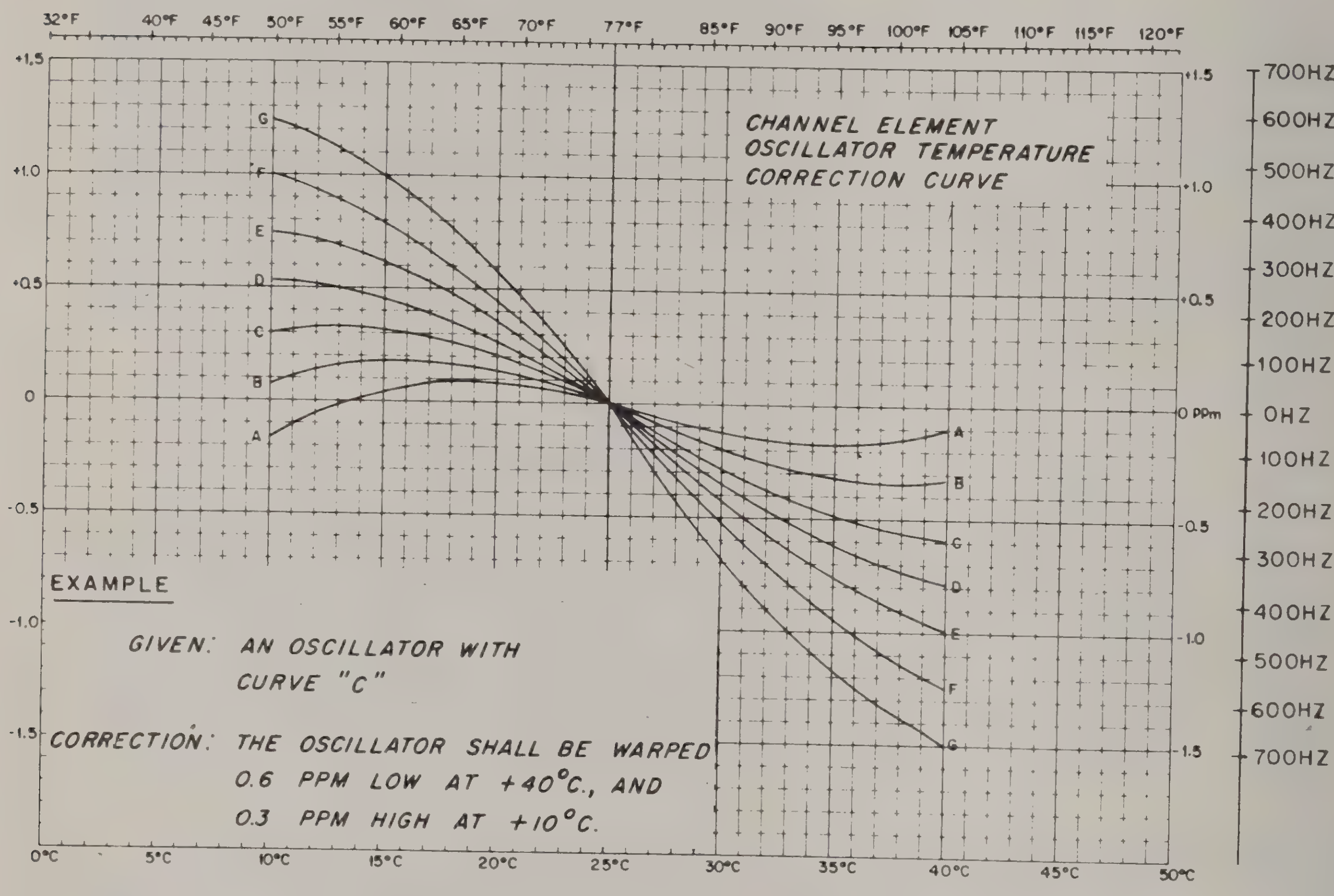


Figure 3.
Oscillator Temperature Correction Curve
(TLN1190A Channel Element)

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual

INSTRUCTION MANUAL AFFECTED:

68P81011E85-O 450-470 MHz Repeater (RT) Station

REVISION DETAILS

1. PAGING CONTROL MODULE

Schematic Diagram No.(s): 63P81005E17

Model(s) and Suffix: TLN1253A (TLN4044A-2)

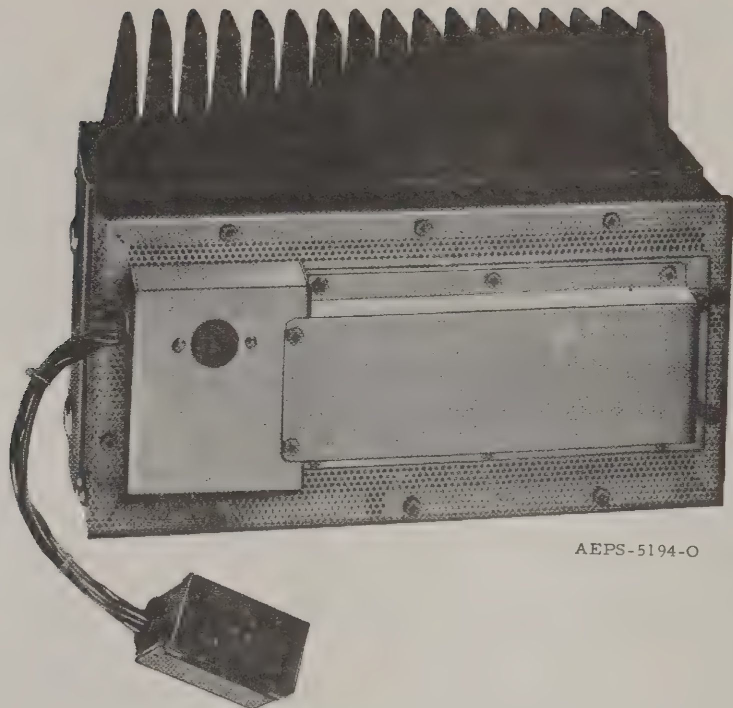
R6 change to 1k ±10%, 1/4 W (Motorola P/N 6S127802).

2. F2 CONTROL MODULE

Schematic Diagram No.(s): 63P81004E94

Model(s) and Suffix: TLN1246A (TLN4044A-2)

R6 change to 1k ±10%, 1/4 W (Motorola P/N 6S127802).



AEPS-5194-O

Front View of Transmitter With
Shield Kit Installed

1. DESCRIPTION

This kit provides additional shielding for the transmitter, and helps to minimize intermodulation effects between stations operating in close proximity to each other.

2. TRANSMITTER ALIGNMENT

The front and rear shield covers can be re moved to gain access to the transmitter fo alignment. The power and rf cables can be lef connected normally during alignment.

MOTOROLA INC.
ENGINEERING PUBLICATIONS
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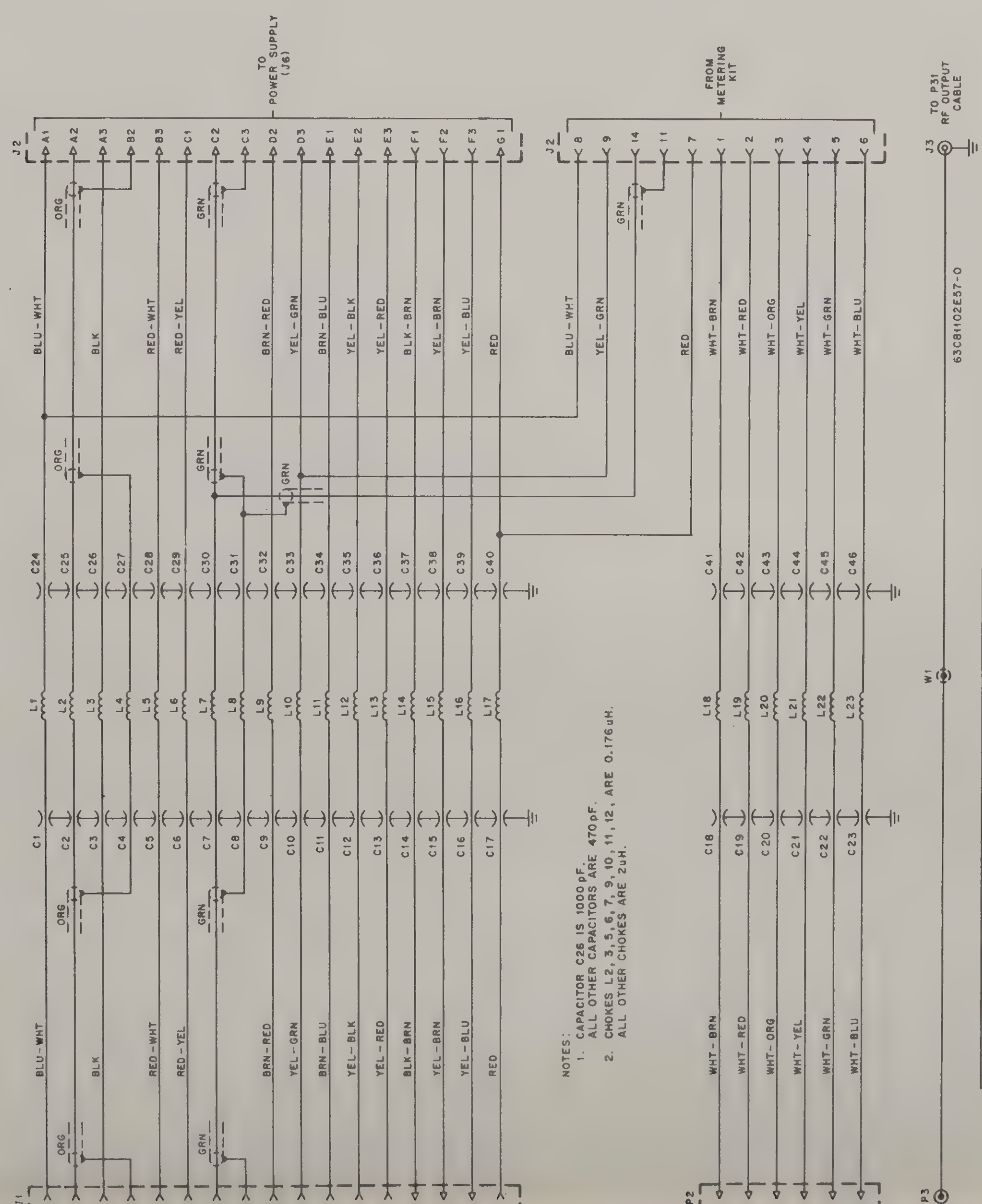
SCHAUMBURG, ILLINOIS 60172



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TLN8888B Transmitter Shield Kit — PL-1241-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1 thru 40	21K821474	CAPACITOR, fixed: 470 pF ±20%; 500 V; coded YEL-VIO-BRN
J1	1V80783A26	CONNECTOR, receptacle: includes: 14C83783A03 BODY; 24-contact type; 29C82336A01 TERMINAL, contact; female 29C82335A01 TERMINAL, contact; male
J2	9C83478E01	female; 12-contact
J3	9C82323G01	female; coaxial; miniature type
		COIL, RF: choke;
L1	24A890687	2 uH
L4	24A890687	2 uH
L8	24A890687	2 uH
L12 thru 23	24A890687	2 uH
L2	24K858989	0.176 uH
L3	24K858989	0.176 uH
L5	24K858989	0.176 uH
L6	24K858989	0.176 uH
L7	24K858989	0.176 uH
L9	24K858989	0.176 uH
L10	24K858989	0.176 uH
L11	24K858989	0.176 uH
P1	1V80783A27	CONNECTOR, plug: includes: 14C82337A09 BODY; 24-contact type; 29C82335A01 TERMINAL, contact; male 29C82336A01 TERMINAL, contact; female
W1	1V80783A31	LINE, RF transmission: includes reference part P3 and 30B859004 CABLE, RF; coaxial; type RG-188/U; 6" length req'd; 11S134371 TUBING, heat-shrinkable; 3/4" length req'd
		NON-REFERENCED ITEMS
	1V80718B75	HOUSING ASSEMBLY: includes reference parts J3, P3, W1
	15D84651C01	COVER, bottom
	15B83190D01	PLATE, inner shield (for doubler, driver and power amplifier stages)
	15C84649C01	COVER, rear
	15C84648C01	COVER, front
	1V80719B31	FILTER ASSEMBLY; includes filtering components, connectors, cables and 37K103664 GROMMET
	15C83094H01	COVER, filter

DRIVER AMPLIFIE

MODEL TLE135

1. DESCRIPTION

This unit is an rf driver amplifier for the 450 MHz to 470 MHz band, employing a vacuum tube with an integral cavity-type tuned circuit. This unit supplies output power of 30-watts. It is fully temperature-compensated and capable of continuous-duty operation.

The driver amplifier includes a self-contained power supply for plate, screen, and control grid bias voltages. RF power output of 30-watts is obtained by using a plate voltage of +500 volts. Filament voltage is provided by the main station power supply.

The rf output of this amplifier is fed through a harmonic filter and then applied to the power amplifier as the signal input.

2. CIRCUIT DESCRIPTION

(Refer to the Driver Amplifier Schematic Diagram.)

a. Amplifier

The input 450 MHz signal to this amplifier is applied through the RF DRIVE coaxial connector (J32) protruding from the side of the amplifier cavity. Approximately 12 watts of rf power is applied to the amplifier grid through a tuned cavity which is tuned to resonance by adjusting the GRID TUNING knob extending from the right-hand end of the amplifier.

Tuning of the plate cavity is accomplished by turning the PLATE TUNING control, a slotted, threaded cap in the wall of the cavity. The amplified rf power in the plate circuit of the driver amplifier is coupled from the plate cavity via the outpu coupling loop to harmonic filter Z1. Z1 attenuate all frequencies above the 450 MHz to 470 MHz ba The filter passes the desired signal throug connector J33 for application as the input to t power amplifier.

b. Power Supply

The self-contained power supply in the driv amplifier contains a plate supply, a "keyed" scre supply, and a grid bias supply.

(1) Plate Supply

The plate supply uses the high-volta secondary winding of power transformer T1 in full-wave bridge rectifier circuit with a capacito input LC filter. The dc output voltage of this circu is applied through rf choke L5 to the "plate line inside the plate cavity.

The portion of the high-voltage seconda winding between the blue leads provides the plat voltage for the power amplifier. The output volta of the plate supply is approximately 500 volts.

(2) Keyed Screen Supply Circuit

As long as keying transistor Q1 is turne on (saturated), the low-voltage secondary windin of power transformer T1 and diodes CR1 and CR provide pulsed driving power to the primary o transformer T2 (grounds the center tap on the T primary). Whenever the transmitter is keyed, Q is turned on by a positive voltage (approximate 12 volts at pin B3 of connector P7. With bo ends of the T2 secondary connected through diod to the gate lead of SCR1, positive pulses ar supplied at a rate of 120 Hz to the SCR gat

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Conduction of the SCR completes the dc path for the full-wave screen supply, and this develops a positive voltage of approximately 390 V across capacitor C2. The voltage across C2 is divided across screen voltage potentiometer R6 and resistor R7. The voltage on the tap of R6 is applied through R8 and rf choke L4 to the screen of power amplifier V1. Resistor R3 is shorted out in 60-watt stations to provide the proper screen voltage.

When the transmitter is unkeyed, a zero-volt signal at P7-B3 keeps Q1 cut off causing an open circuit between the center tap of the T2 primary and ground. With the center tap ungrounded, no current can flow in the primary of T2 due to the presence of blocking diodes CR1 and CR2 (on either alternation, one of the two diodes is reverse-biased, preventing current flow). With no primary current in T2, there is no voltage induced in its secondary, and the source of gate pulses for SCR1 is lost. SCR1 is therefore non-conductive, cutting off the screen voltage to power amplifier V1.

(3) Grid Bias Supply

The voltage across one half of the low-voltage secondary winding of T1 is rectified by diode CR9 and filtered by C3 and R9 producing approximately 25 volts of negative bias for the control grid of V1. This fixed bias is applied through rf choke L2 to the control grid of V1.

In addition to fixed bias, the power amplifier also develops its own "excitation" (grid-leak) bias across resistor R10. This occurs when the rf grid voltage exceeds the fixed bias voltage causing the control grid to become positive and draw grid current.

Approximately 45 volts of grid bias (total) is developed across R10 with a normal full rf drive of approximately 12 watts present at input connector J32 (note that R10 also serves as a bleeder resistor across the fixed bias supply).

R15 is a metering resistor for measuring the grid bias voltage at pin 6 of metering socket J22. C4 and C7 are bypass capacitors to prevent any stray rf voltage on the grid lead from being coupled back through the power supply.

3. ALIGNMENT PROCEDURE

The driver amplifier alignment instructions are included in the "Exciter-Transmitter" and the "High Power Amplifier" alignment section of this manual. The alignment tool used for the driver amplifier is the long end of tuning tool C (detail shown with alignment procedure).

4. SERVICE AIDS

The following items are provided to aid in servicing the driver amplifier:

a. Tube removal procedure including two illustrations (Detail A and Detail B).

b. Front and rear illustrations showing locations of component parts including alignment adjustments.

c. Exploded view and parts list for cavity assembly.

d. A rectifier and control circuit board detail showing locations of all component parts and conductive paths on the board.

e. Driver amplifier schematic diagram.

DRIVER AMPLIFIER TUBE REMOVAL

WARNING

Before proceeding, turn off power ON-OFF switch at lower left-hand side of the driver amplifier chassis and OFF-VOLUME switch on the control panel of local control stations.

If the driver amplifier cavity is hot, proceed with caution.

Refer to Driver Amplifier Tube Removal Details A and B.

(1) Disengage the clamps at the top and bottom of the cavity and fold them back to the left so they will be out of the way.

(2) Insert a "Phillips" screwdriver through the hole in the plate cavity (see Tube Removal Detail A) until it engages the screw head inside the cavity. Loosen the clamp by turning the screw counterclockwise.

(3) By exerting a right hand pull on the grid cavity, the clamp will release and the grid cavity will begin to separate from the plate cavity. After the right half of the cavity separates from the left half, continue pulling straight to the right until the top of the "lighthouse" amplifier tube clears the left half of the cavity.

(4) Remove the screwdriver from the hole in the cavity.

(5) Grasp the grid cavity firmly with one hand and the amplifier tube with the other hand as shown in Tube Removal Detail B. Rock the tube gently back and forth while pulling to help free it from the socket.

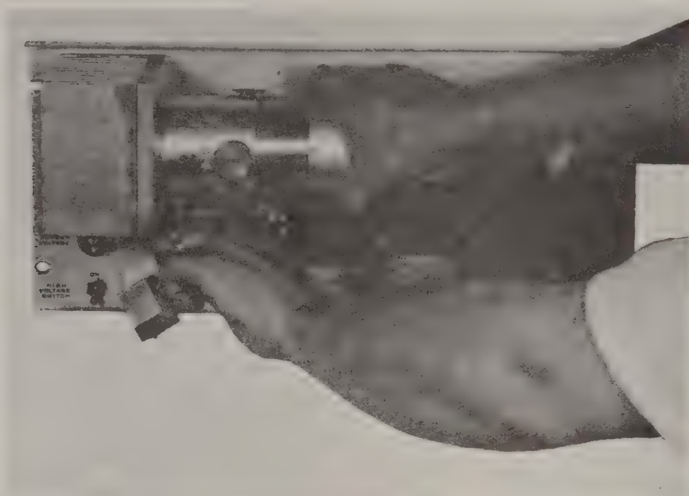
(6) Replace the driver amplifier tube in the opposite sequence.

(7) After the driver amplifier is complete reassembled, insert the screwdriver again and tur it clockwise to tighten the clamp.

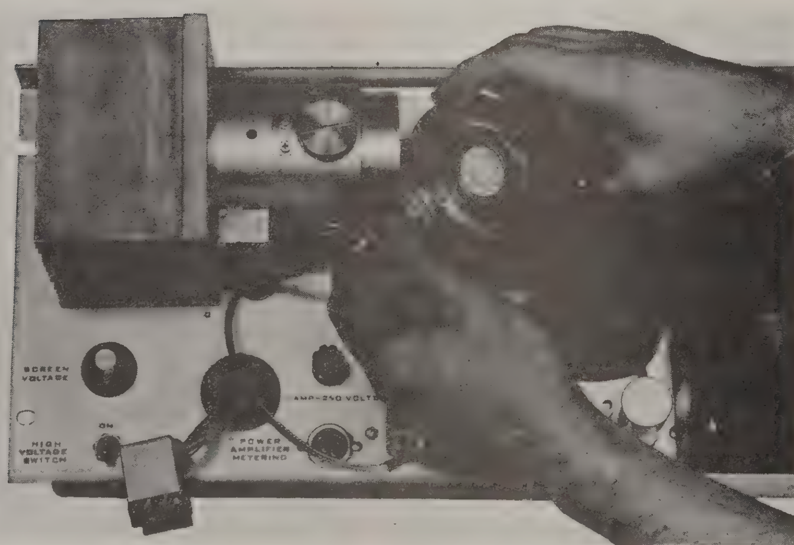
WARNING

Tighten tube clamp securely.

(8) Remove the screwdriver and refer to the Transmitter Alignment Procedure.



Driver Amplifier Tube Removal Detail A



Driver Amplifier Tube Removal Detail B

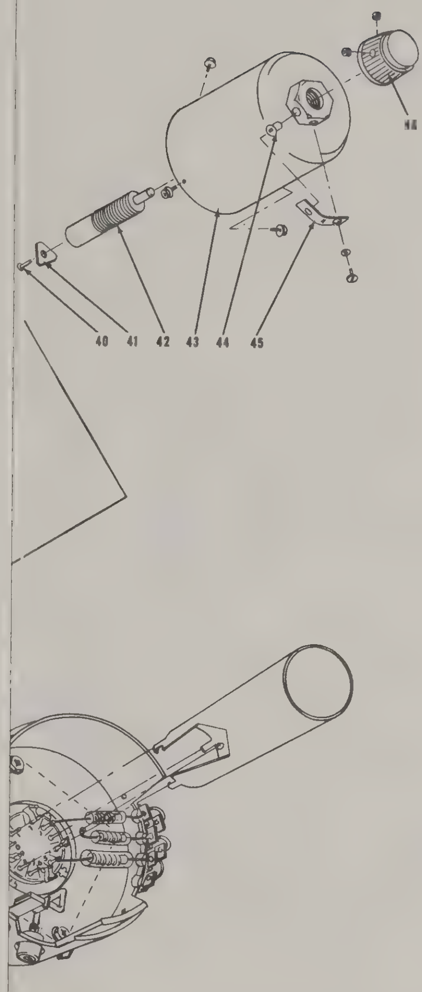
PARTS LIST

PL-672-A

CODE	MOTOROLA PART NO.	DESCRIPTION
1	26B83909G01	HEAT SINK
2	14B83906G01	INSULATOR
3	4B82345A11	SHOULDER WASHER
4	*	PLATE LINE
6	1V80706B72	PLATE LINE CLAMP ASSY
7	36A83984G02	PLATE TUNING KNOB
8	*	RF CHOKE (L5)
9	29B83988G01	FEED THRU TERMINAL
10	43B84213A01	ALUMINUM PLUNGER
11	7B83900G01	TUNING BRACKET
12	37A83173H01	TEFLON INSULATOR
13	3B83908G01	PLATE TUNING SCREW
14	*	DISC CAPACITOR (C14)
15	37C82633B09	RUBBER GROMMET
16	15B83992G01	FEED THRU COVER
17	55A879705	DRAW-PULL CATCH
18	32A83384H01	HOUSING SHIM
19	**4A84401A01	SPECIAL WASHER
20	**14A84400A01	COUPLING LOOP INSULATOR
21	**2A83383H01	NUT
22	**24B83996G01	OUTPUT COUPLING LOOP
23	**4C82414E06	SPRING WASHER
24	**15B83997G01 **47A82427E03 **47C83028H01	HARMONIC FILTER
25	**14A83191H01	INSULATOR SPACER
*26	3A83907G01	PLUG SCREW
27	58D83985G01	PLATE CAVITY
28	*	TUBE (V1)
29	*	SCREEN BYPASS CAPACITOR (C11)
30	*	TUBE SOCKET (XV1)
31	42D83995G01	SOCKET MOUNTING RING
32	55A83990G01	STRIKE
33	*	RF CHOKE (L4)
34	*	RF CHOKE (L2)
35	*	RF CHOKE (L3)
36	1V80781A71	CAPACITORS AND MTG ASSY
37	47B83989G01	GRID LINE
38	21D82785H16 42A82765C03	CAPACITOR AND BRACKET (C-13)
39	24B83987G01	GRID COUPLING LOOP
40	3S8154	DRIVE SCREW
41	43B83904G01	TEFLON SPACER
42	76A83905G01	GRID TUNING SLUG
43	58B83993G01	GRID CAVITY
44	47B83910G01	NYLON PLUNGER
45	41B83901G01	RETAINING SPRING
46	36B83579B01	CONTROL KNOB

NOTES:

*See Electrical Parts List
**Part of Harmonic Filter Assembly, 1V80781A75, It is recommended that the entire assembly be replaced.



DEPS-2758-B

DRIVER AMPLIFIER

Driver Amplifier Cavity
Mechanical Parts Detail
Motorola No. DEPS-2758-B
4/21/71-UP

(4) Remove the screwdriver from the hole in the cavity.

(5) Grasp the grid cavity firmly with one hand and the amplifier tube with the other hand as shown in Tube Removal Detail B. Rock the tube gently back and forth while pulling to help free it from the socket.

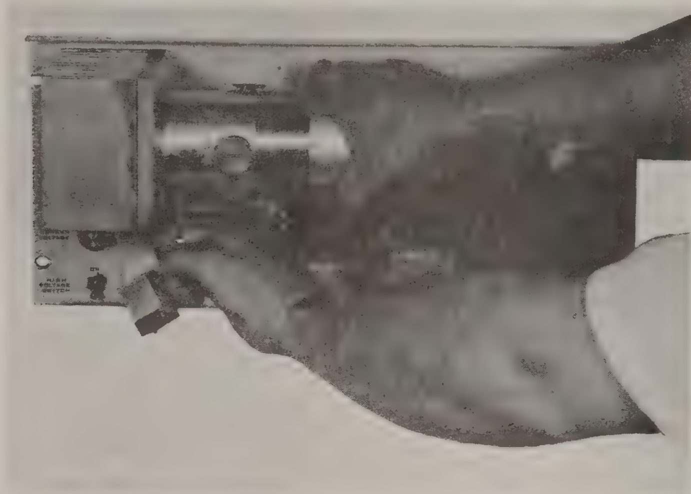
(6) Replace the driver amplifier tube in the opposite sequence.

(7) After the driver amplifier is complet reassembled, insert the screwdriver again and tu it clockwise to tighten the clamp.

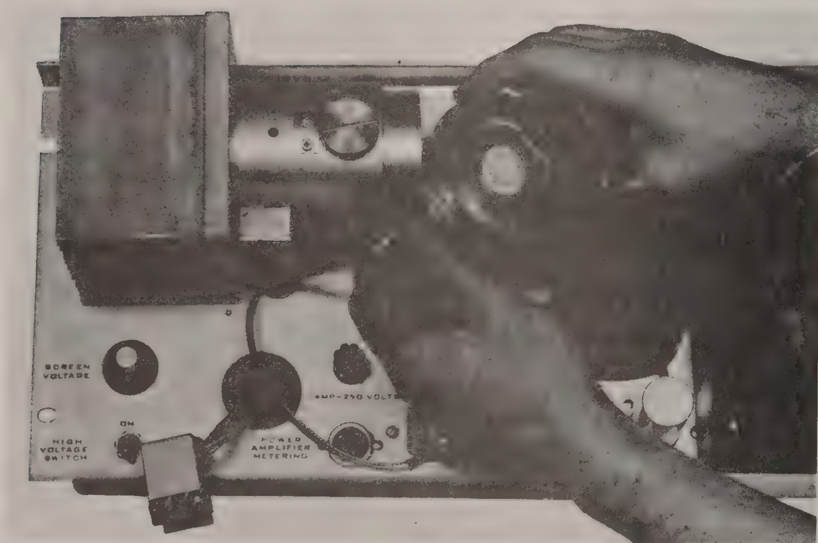
WARNING

Tighten tube clamp securely.

(8) Remove the screwdriver and refer to tl Transmitter Alignment Procedure.



Driver Amplifier Tube Removal Detail A



Driver Amplifier Tube Removal Detail B

PARTS LIST

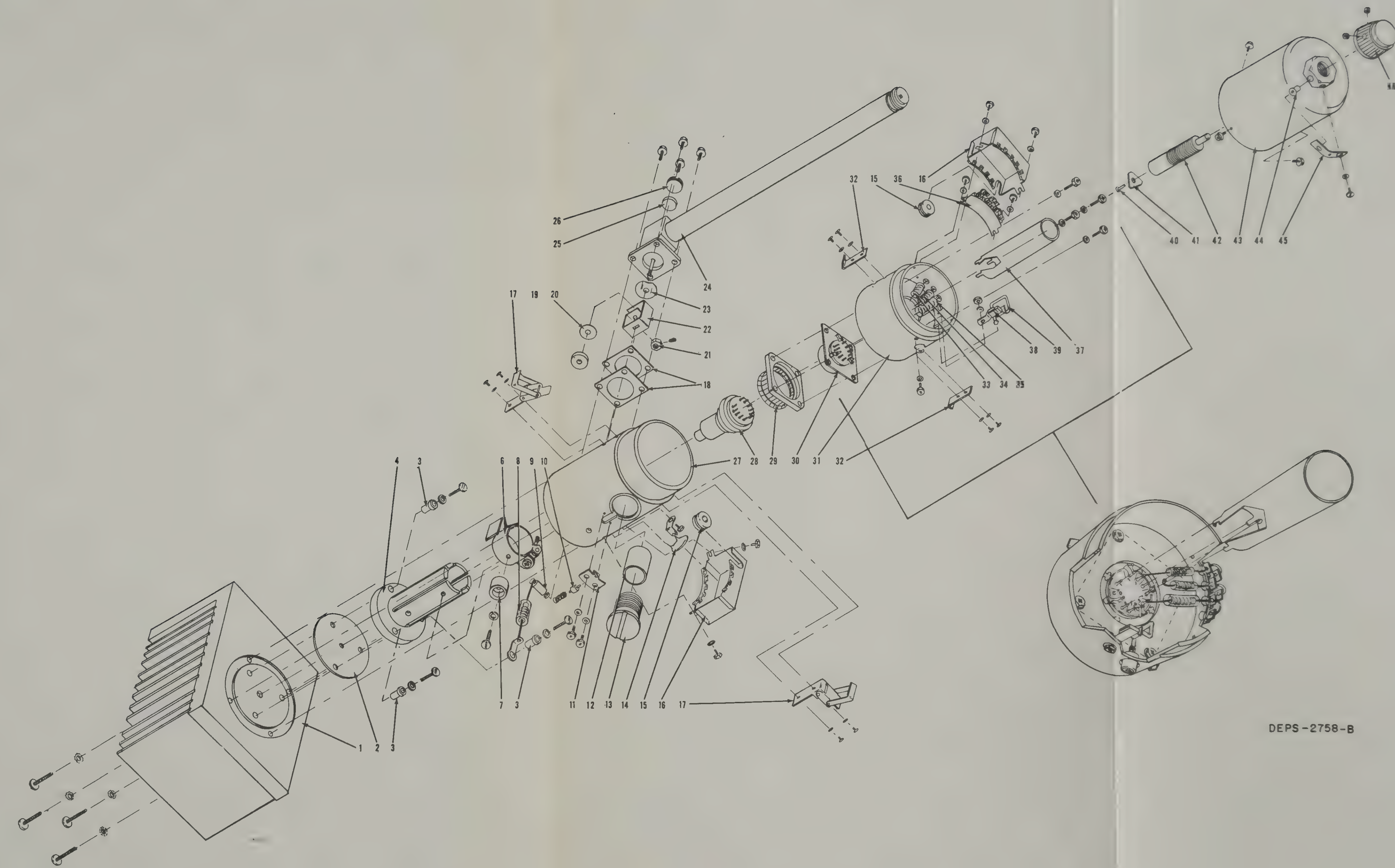
PL-672-A

CODE	MOTOROLA PART NO.	DESCRIPTION
1	26B83909G01	HEAT SINK
2	14B83906G01	INSULATOR
3	4B82345A11	SHOULDER WASHER
4	*	PLATE LINE
6	1V80706B72	PLATE LINE CLAMP ASSY
7	36A83984G02	PLATE TUNING KNOB
8	*	RF CHOKE (L5)
9	29B83988G01	FEED THRU TERMINAL
10	43B84213A01	ALUMINUM PLUNGER
11	7B83900G01	TUNING BRACKET
12	37A83173H01	TEFLON INSULATOR
13	3B83908G01	PLATE TUNING SCREW
14	*	DISC CAPACITOR (C14)
15	37C82633B09	RUBBER GROMMET
16	15B83992G01	FEED THRU COVER
17	55A879705	DRAW-PULL CATCH
18	32A83384H01	HOUSING SHIM
19	**4A84401A01	SPECIAL WASHER
20	**14A84400A01	COUPLING LOOP INSULATOR
21	**2A83383H01	NUT
22	**24B83996G01	OUTPUT COUPLING LOOP
23	**4C82414E06	SPRING WASHER
24	**15B83997G01 **47A82427E03 **47C83028H01	HARMONIC FILTER
25	**14A83191H01	INSULATOR SPACER
*26	3A83907G01	PLUG SCREW
27	58D83985G01	PLATE CAVITY
28	*	TUBE (V1)
29	*	SCREEN BYPASS CAPACITOR (C11)
30	*	TUBE SOCKET (XV1)
31	42D83995G01	SOCKET MOUNTING RING
32	55A83990G01	STRIKE
33	*	RF CHOKE (L4)
34	*	RF CHOKE (L2)
35	*	RF CHOKE (L3)
36	1V80781A71	CAPACITORS AND MTG ASSY
37	47B83989G01	GRID LINE
38	21D82785H16 42A82765C03	CAPACITOR AND BRACKET (C-13)
39	24B83987G01	GRID COUPLING LOOP
40	3S8154	DRIVE SCREW
41	43B83904G01	TEFLON SPACER
42	76A83905G01	GRID TUNING SLUG
43	58B83993G01	GRID CAVITY
44	47B83910G01	NYLON PLUNGER
45	41B83901G01	RETAINING SPRING
46	36B83579B01	CONTROL KNOB

NOTES·

*See Electrical Parts List

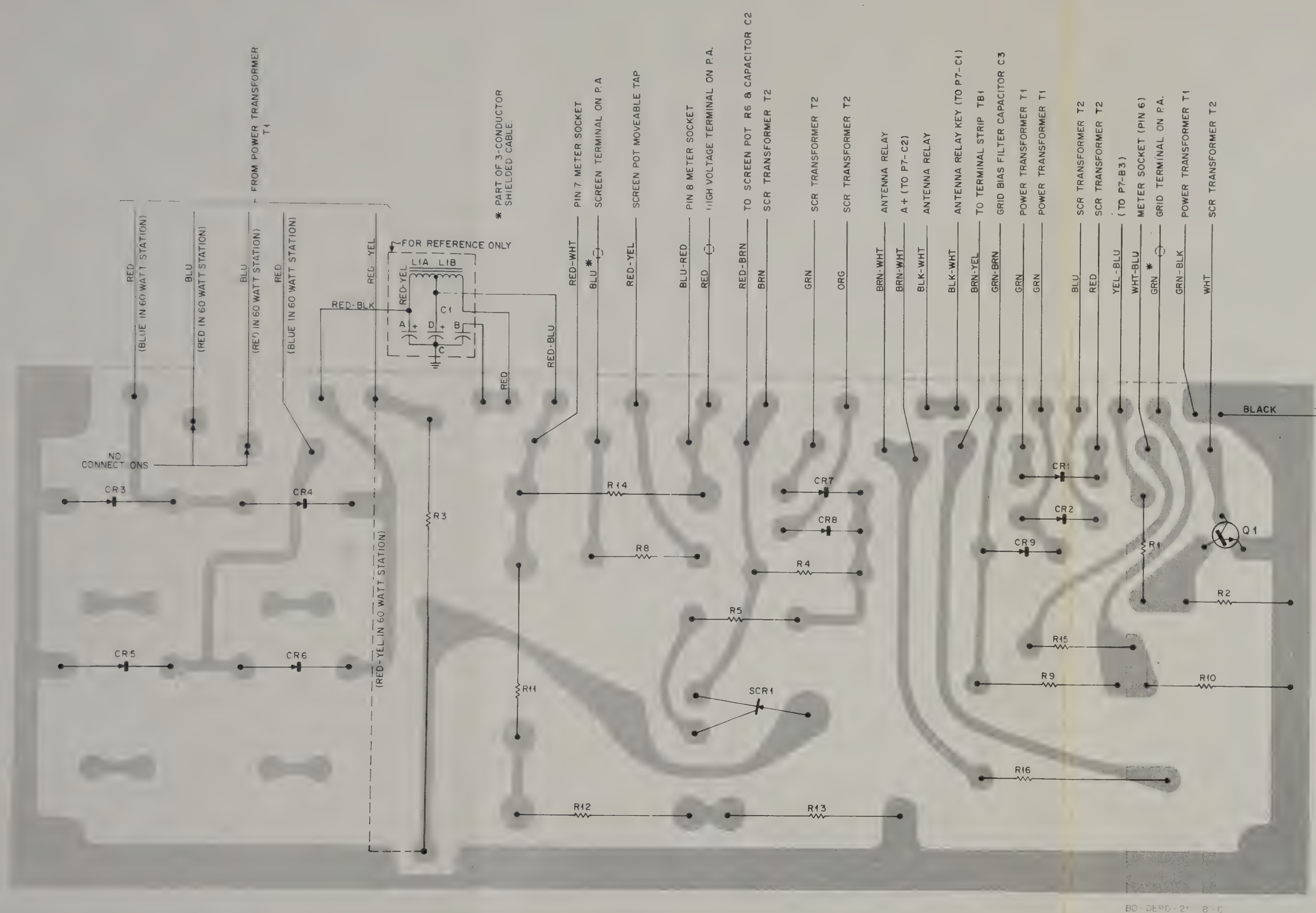
**Part of Harmonic Filter Assembly, 1V80781A75, It is recommended that the entire assembly be replaced.

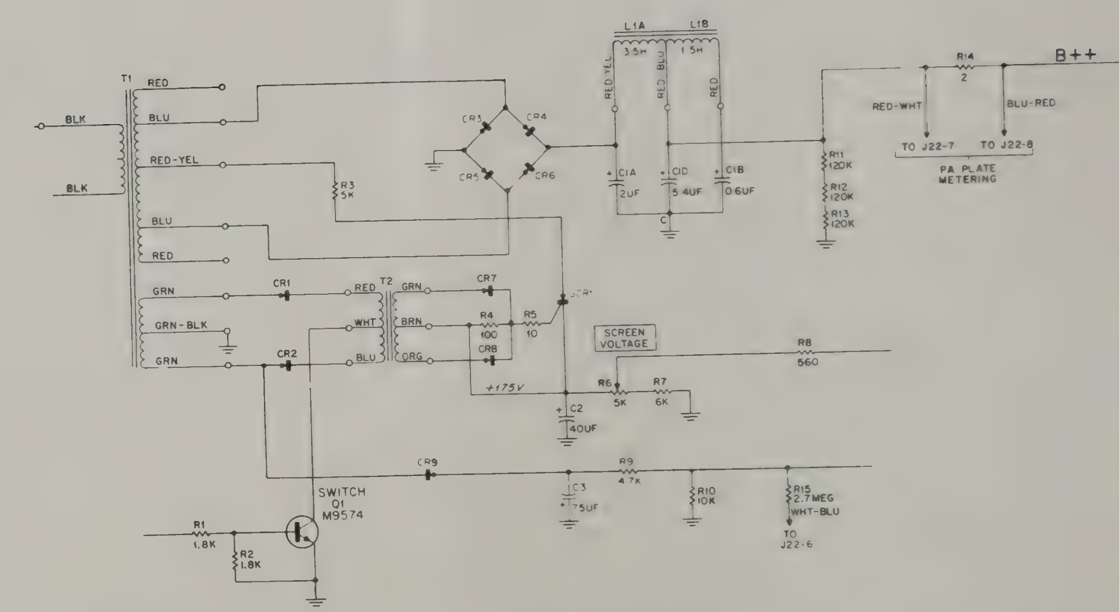


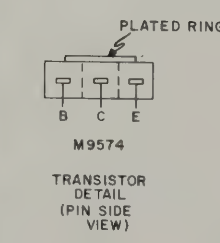
DEPS-2758-B

DRIVER AMPLIFIER

Driver Amplifier Cavity
Mechanical Parts Detail
Motorola No. DEPS-2758-1
4/21/71-UP

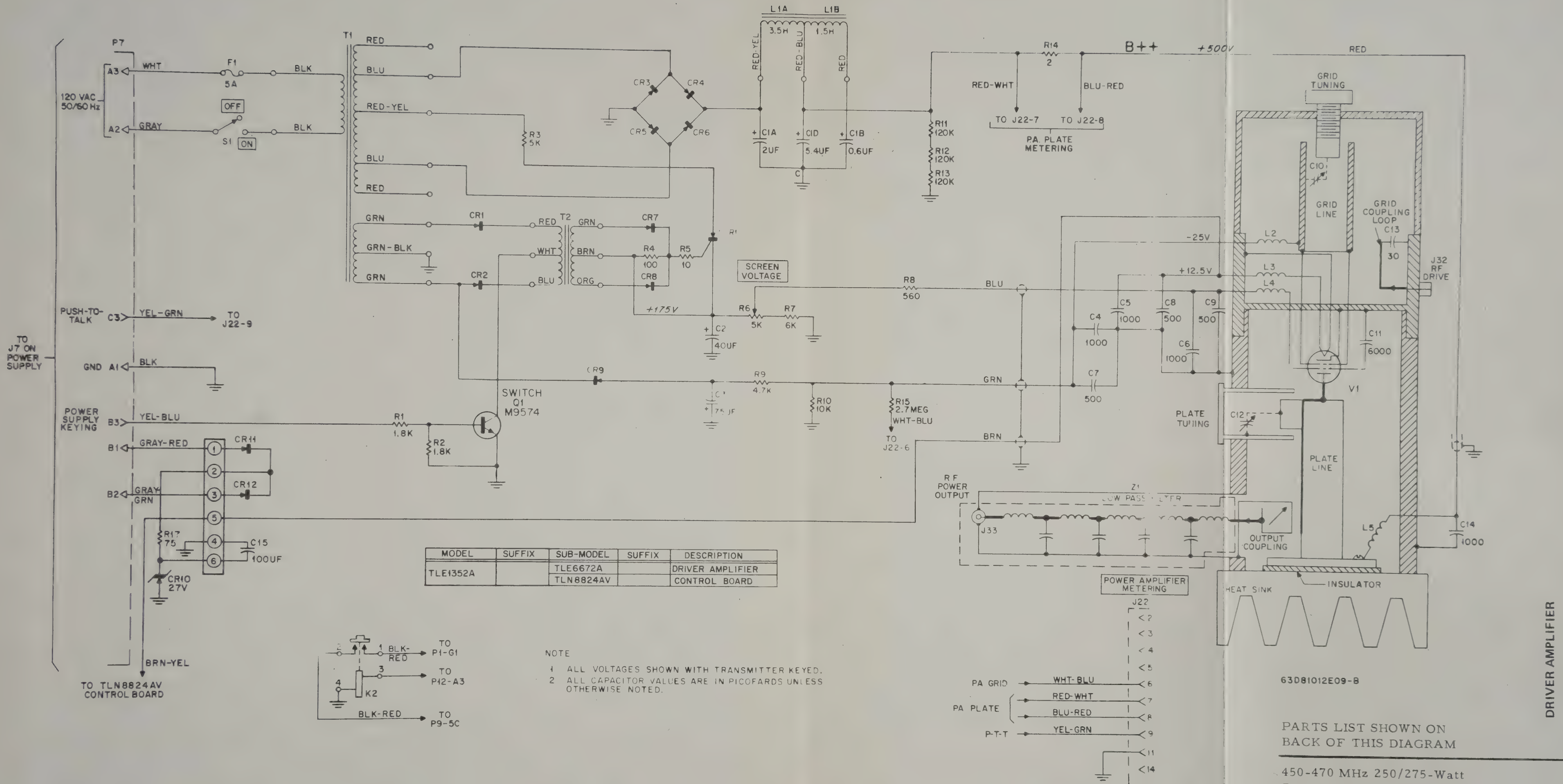






REFER TO COMPLETE SCHEMATIC
DIAGRAM FOR NOTE REFERENCES
AND PARTS LIST

TLN8824AV Rectifier & Control
Circuit Board Detail
Motorola No. PEPS-5301-A
1/28/72-UP



MODEL	SUFFIX	SUB-MODEL	SUFFIX	DESCRIPTION
TLE1352A		TLE6672A		DRIVER AMPLIFIER
		TLN8824AV		CONTROL BOARD

NOTE

1 ALL VOLTAGES SHOWN WITH TRANSMITTER KEYED.
2 ALL CAPACITOR VALUES ARE IN PICOFARADS UNLESS OTHERWISE NOTED.

63D81012E09-B

DRIVER AMPLIFIER

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

450-470 MHz 250/275-Watt
Base and Repeater Stations
Driver Amplifier and Power Supply
Schematic Diagram
Motorola No. 63D81012E09-B
1/28/72-UP

FERENCE YMBOL	MOTOROLA PART NO.	DESCRIPTION
	1V80706B73	PLATE LINE & CAVITY ASSY, incl. ref part C12, C14, L5 and the following 1V80706B72 PLATE LINE CLAMP ASSY (secures tube socket & grid line assy in place; 2 catches req'd) 7B83900G01 BRACKET, plunger retainer, 41A83877E01 SPRING, plunger compression 43B84213A01 "PLUNGER" (metallic); friction stop for plate tuning screw, 4B82345A11 WASHER, shoulder: insulating (3 req'd) 14B83906G01 INSULATOR, plate line mtg (NOTE: This item may be replaced, but careful alignment of the assembly is req'd).
	1V80701B81	GRID DRIVE CABLE ASSY
	1V80781A68	TUBE SOCKET & GRID LINE ASSY: incl. the following replaceable parts and sub-assemblies: Ref. Part C11, 24B83987G01 GRID COUPLING LOOP, 1V80784A17 CAPACITOR & CLAMP ASSEMBLY, 1V80781A73 GRID TUNING SCREW ASSEMBLY 1V80781A74 GRID CAVITY & NUT ASSEMBLY 47B83910G01 "PLUNGER" (nylon); friction stop for grid tuning screw, 41B83901G01 SPRING, plunger compressor 36B82632H07 KNOB, control (grid tuning), 47B83989G01 GRID LINE, 1V80781A71 CAPACITORS & BRACKET ASSEMBLY: incl. C4 thru C9 NOTE Do not attempt to replace any parts of 1V80781A68 TUBE SOCKET & GRID LINE ASSY or 1V80706B73 PLATE LINE & CAVITY ASSY unless they appear in the above listing. Instead, order a new replacement assembly.
	1V80717B72	PANEL ASSY (riveted)incl. ref. item J22

:

'or optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

POWER AMPLIFIER

MODEL TLE1360A
(FORMERLY MODEL SP7010729)

POWER AMPLIFIER SPECIFICATIONS

FREQUENCY RANGE	450-470 MHz
RF POWER INPUT REQUIRED	30-40 watts
RF POWER OUTPUT	250/275 watts
POWER SUPPLY REQUIREMENTS	1500 volts dc @400 mA

FCC LICENSE DESIGNATIONS

250 watts CC4101CF
275 watts CC4101C

DESCRIPTION

This unit has an output of 250 or 275 watts (depending upon tuning and FCC licensing) and operates in the 450-470 MHz range. It has two type 4CX250B tubes connected into a push-pull, class C amplifier circuit. The grid circuit has a tuned resonant coaxial line; the plate circuit has resonant cavities with coarse and fine tuning adjustments. Input and output coupling loops match 50-ohm coaxial lines.

A 450-470 MHz, 30 to 40 watt input signal is required to drive this amplifier to its rated rf output. Drive is balanced by the two grid circuit tuning capacitors. No neutralizing procedure is required. Ordinary metallic screwdrivers can be used to tune the grid capacitors and plate circuit fine tuning vane.

WARNING

Operation of this equipment involves high voltages which are hazardous to personal safety. Death on contact may result if safety precautions are not observed.

Do not remove the cover of the tube compartment with the high voltage switch at the base of the cabinet turned on. Under no circumstances should any safety interlock be removed, short circuited, or tampered with in any way.

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REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLE1352A Driver Amplifier PL-1251-A

		CAPACITOR, fixed:
C1	8C84195A01	3 sec; c/o:
C1A		2 uF +20-10%; 1200 V
C1B		0.6 uF ±10%; 1200 V
C1D		5.4 uF +20-10%; 1200 V
		NOTE 'C' denotes common connection.
C2	23D83093G06	40 uF +150-10%; 450 V
C3	23D82304B28	75 uF +100-10%; 250 V
C4 thru 9		(replaceable as an assembly only): order 1V80781A71 CAPACITOR ASSEMBLY
C10		(for reference only; inherent capacitance in grid circuit)
C11	21C84636A01	6000 pF ±1000 pF; 500 V
C12		tuning capacitance; c/o the following items 1V80783A56 PLATE TUNING SCREW ASSY. (adjustable); 36A83984G01 SLUG, metallic: (stationary; mounts on plate line)
C13		(for replacement, order 1V80784A17 CAPACITOR & CLAMP ASSY.)
C14	21K868902	1000 pF ±20%; 3000 V
C15	23D82077C01	100 uF
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48C82466H13	silicon
CR2	48C82466H13	silicon
CR3	48C83024H01	silicon
CR4	48C83024H01	silicon
CR5	48C83024H01	silicon
CR6	48C83024H01	silicon
CR7	48C82466H13	silicon
CR8	48C82466H13	silicon
CR9	48C82466H13	silicon
CR10	48C82137H02	Zener; 27 V
CR11	48C82466H18	silicon
CR12	48C82466H18	silicon
		FUSE, cartridge: 1-1/4" x 1/4"
F1	65R52293	5 A; 250 V
		CONNECTOR, receptacle:
J22	9C82201E01	female; 12 cont
J32		female; coaxial; (for reference only; field-replacement not recommended)
J33		female; coaxial; (for reference only; field-replacement not recommended)
		RELAY:
K2	80C82015H01	1 form "X" (spst) coil res 400 ohm ±10%: does not include 15B84559C01 cover, relay
		REACTOR:
L1	25C83962A01	2 sect; c/o:
L1A		3.5 H; res 48 ohms ±10%
L1B		1.5 H; res 80 ohms ±10%
		COIL, RF: choke:
L2	24C82542E08	.039 uH
L3	24C84346A01	6 turns
L4	24C82542E08	.039 uH
L5	24C82542E08	.039 uH
		CONNECTOR, plug:
P7		c/o: 14C82337A03 BODY, 29C82335A01 TERMINAL, cont; male (specify qty); 29C82336A01 TERMINAL, cont; female (specify qty) 15C83934A07 COVER
		TRANSISTOR: (SEE NOTE)
Q1	48R869574	N-P-N; type M9574

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		RESISTOR, fixed: ±10%; 1/2 W unl stated
R1	6S2089	1.8k
R2	6S2089	1.8k
R3	17D82177B22	5k; 10 W
R4	6S6326	100
R5	6S5621	10
		RESISTOR, variable:
R6	18C82782H01	5k ±10%; 25 W; does not incl. 14B83143H01 INS. mtg. and 36B83764G01 KNOB, control
		RESISTOR, fixed:
R7	17K804758	6k ±10%; 25 W
R8	6S6291	560
R9	6S5576	4.7k; 1 W
R10	6S6430	10k; 1 W
R11	6S5781	120k; 2 W
R12	6S5781	120k; 2 W
R13	6S5781	120k; 2 W
R14	17K847359	2 ±2%; 1 W
R15	6S488186	2.7 meg ±5%; 1/2 W
R16	17D83027H06	0.75 ±5%; 5 W
R17	17D82177B29	75
		SWITCH, toggle
S1	40B858304	spst: does not include 14B84446A01 insulator, switch
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
SCR1	48R869349	controlled type
		TRANSFORMER, power: 120 V; 60 Hz
T1	25D84124A01	pri: BLK, BLK; res 0.873 ohm ±20%; sec No. 1: RED, RED w/RED-YEL center tap (680 volts, no load); incl. intermediate BLU taps (500 volts no load); total res 25.72 ohms ±20%; sec No. 2 BLU, BLU; (res not stated); sec No. 3 GRN, GRN w/GRN-BLK center tap; res 7.2 ohms ±20%
		TRANSFORMER, control: 25 V ac; 60 Hz:
T2	25C83023H01	pri: RED, BLU w/WHT center tap; sec: GRN, ORG w/BRN center tap
		ELECTRON TUBE:
V1	65C83999G01	11 cont base
		FUSEHOLDER:
XF1	9C82983C01	extractor post type
		FILTER, RF: low-pass:
Z1	1V80781A75	"harmonic filter"; field repair and/or adjustment not recommended (replace entire unit only)
		NON-REFERENCED ITEMS
	31S121227	TERMINAL BOARD: wafer type; 6 soldering terminals (5 insulated and 1 mtg)
	64A851940	PLATE, capacitor mtg (for C2)
	64A10844	PLATE, capacitor mtg; ins. (for C3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1V80706B73	PLATE LINE & CAVITY ASSY, incl. ref part C12, C14, L5 and the following 1V80706B72 PLATE LINE CLAMP ASSY (secures tube socket & grid line assy in place; 2 catches req'd) 7B83900G01 BRACKET, plunger retainer, 41A83877E01 SPRING, plunger compression 43B84213A01 "PLUNGER" (metallic); friction stop for plate tuning screw, 4B82345A11 WASHER, shoulder: insulating (3 req'd) 14B83906G01 INSULATOR, plate line mtg (NOTE: This item may be replaced, but careful alignment of the assembly is req'd).
	1V80701B81	GRID DRIVE CABLE ASSY
	1V80781A68	TUBE SOCKET & GRID LINE ASSY: incl. the following replaceable parts and subassemblies: Ref. Part C11, 24B83987G01 GRID COUPLING LOOP, 1V80784A17 CAPACITOR & CLAMP ASSEMBLY, 1V80781A73 GRID TUNING SCREW ASSEMBLY 1V80781A74 GRID CAVITY & NUT ASSEMBLY 47B83910G01 "PLUNGER" (nylon); friction stop for grid tuning screw, 41B83901G01 SPRING, plunger compressor 36B82632H07 KNOB, control (grid tuning), 47B83989G01 GRID LINE, 1V80781A71 CAPACITORS & BRACKET ASSEMBLY: incl. C4 thru C9 NOTE Do not attempt to replace any parts of 1V80781A68 TUBE SOCKET & GRID LINE ASSY or 1V80706B73 PLATE LINE & CAVITY ASSY unless they appear in the above listing. Instead, order a new replacement assembly.
	1V80717B72	PANEL ASSY (riveted)incl. ref. item J22

NOTE:

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

POWER AMPLIFIER

MODEL TLE1360A
(FORMERLY MODEL SP7010729)

POWER AMPLIFIER SPECIFICATIONS

FREQUENCY RANGE	450-470 MHz
RF POWER INPUT REQUIRED	30-40 watts
RF POWER OUTPUT	250/275 watts
POWER SUPPLY REQUIREMENTS	1500 volts dc @400 mA

FCC LICENSE DESIGNATIONS

250 watts	CC4101CF
275 watts	CC4101C

DESCRIPTION

This unit has an output of 250 or 275 watts (depending upon tuning and FCC licensing) and operates in the 450-470 MHz range. It has two type 4CX250B tubes connected into a push-pull, class C amplifier circuit. The grid circuit has a tuned resonant coaxial line; the plate circuit has resonant cavities with coarse and fine tuning adjustments. Input and output coupling loops match 50-ohm coaxial lines.

A 450-470 MHz, 30 to 40 watt input signal is required to drive this amplifier to its rated rf output. Drive is balanced by the two grid circuit tuning capacitors. No neutralizing procedure is required. Ordinary metallic screwdrivers can be used to tune the grid capacitors and plate circuit fine tuning vane.

WARNING

Operation of this equipment involves high voltages which are hazardous to personal safety. Death on contact may result if safety precautions are not observed.

Do not remove the cover of the tube compartment with the high voltage switch at the base of the cabinet turned on. Under no circumstances should any safety interlock be removed, short circuited, or tampered with in any way.

MOTOROLA INC. Communications Division
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POWER AMPLIFIER TROUBLESHOOTING TABLE

LOW OR NO RF OUTPUT CONDITIONS

SYMPTOM	PROCEDURE
Loss of Grid Bias to V1 and V2	1. Check bias supply voltage. Reading should be approximately -50 V dc measured between TB1-5 and ground. 2. Check R1. 3. Check C3 and L3. 4. Check and replace defective tube(s).
Loss of Grid Drive to V1 and V2	1. Check for open or shorted rf input lead and connector. 2. Check L2 input coupling loop. 3. Check exciter and driver amplifier. 4. Check and replace defective tube(s).
Loss of High Voltage	1. Check for High Voltage Power Supply failure. 2. Check "feed-thru" capacitors C11 and C12. 3. Check remote control chassis. 4. Check interlock circuit.
Power Supply Overload (overload circuit actuates to disconnect 1500 V supply)	Disconnect high voltage connector P13 and check: 1. Plate voltage meter reading (1500 V). 2. For short between B+ lead and ground.
Loss of Plate Current (high plate voltage)	1. Check and replace defective tube(s). 2. Check screen voltage. Reading should be approximately 300 V dc measured between TB1-8 and ground. 3. Check R2, R3, and R4. 4. Check filament voltage. Reading should be 5.5 V ac (nominal) measured between TB1-7 and ground. 5. Check screen control. Resistance should be 10K from TB1-8 to ground. 6. Check grid drive. Transmitter keyed reading should be at least 20 V higher than the fixed bias (unkeyed) reading.
Excessive Plate Current	1. Check bias supply voltage. Reading should be approximately -50 V dc measured from TB1-5 and ground. 2. Check R4 setting. 3. Check and replace defective tube(s). 4. Check alignment. Refer to the appropriate alignment procedure included in this manual. 5. Check for defective components in the plate circuit. 6. Check for shorted harmonic filter and open or shorted antenna transmission line.
Improper input power to final (as licensed by FCC)	1. Check supply voltages. 2. Check alignment. Refer to the appropriate alignment procedure. 3. Replace defective tube(s). 4. Check antenna system.
DC input power OK, rf output power low.	1. Check antenna relay (where applicable) for pitted or dirty contacts. 2. Check harmonic filter. 3. Check alignment. Refer to the appropriate alignment procedure. 4. Check and replace defective tube(s).

POWER AMPLIFIER ALIGNMENT

STEP	ADJUSTMENT	METER READING	PROCEDURE
1	Hi-Voltage On-Off Switches	1 or 2	Set Hi-voltage on-off switches, accessible with front door open, to ON position.
2	Driver Amplifier Screen Voltage (Knob)		Rotate screen voltage pot R6 on the Driver Amplifier to the maximum ccw position.
3	Power Amplifier SCREEN VOLTAGE (knob)		Rotate screen voltage pot R4 on the Power Amplifier to the maximum ccw position.
4	Ant. Coupling Loop, L1 (knob)	Dip on Wattmeter	Key test set briefly and decouple the antenna for lowest possible reading on wattmeter.
5	Plate Tuning Control, Z1	Dip on Amplifier Plate Meters (Upper & Lower)	Key test set. Use ordinary metallic screwdriver to tune Z1 for dip reading on plate current meters. Dip should occur when tuning slot is more than 30° from vertical or horizontal positions. If dip does not occur within this range, refer to tuning procedure for Z2 and Z3.
6	Ant. Coupling Loop, L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
7	Grid Tuning Controls, C1 & C2	Peak on Amplifier Grid Meter and Balance on Amplifier Plate Meters	Use ordinary metallic screwdriver. Tune C1 and C2 for maximum (peak) reading on amplifier grid meter and equal meter readings on the amplifier plate meters. If grid reading exceeds 40 mA, adjust driver output coupling loop L1, to reduce meter reading and proceed to step 9. If reading of 40 mA cannot be reached, proceed to step 8. CAUTION Do not overdrive. Overdriving occurs when continued clockwise rotation of the driver amplifier Screen Voltage knob reduces power output of the 275 W amplifier.
8	Driver Amplifier Screen Voltage (knob)	Peak on Amplifier Grid Meter and Balance on Amplifier Plate meters	Turn knob clockwise for a 40 mA reading on grid meter. CAUTION Do not overdrive. Overdriving occurs when continued clockwise rotation of the driver amplifier Screen Voltage knob reduces power output of the 275 W amplifier.
9	Plate Tuning Control, Z1	Dip on Amplifier Plate Meter (Upper & Lower)	Tune Z1 for dip on amplifier plate meters. Note reading on each meter. If meter readings differ retune C1 and C2 to equalize readings. C1 tunes upper amplifier, C2 tunes lower. Balance meter readings by tuning to midpoint of original readings noted. Recheck Z1 for dip on each meter when balanced. NOTE Tuning C1 will have an effect on the plate current readings for both final tubes. One reading will increase while the other decreases. Tuning C2 will reverse this situation. By careful adjustment of C1 and C2, the plate currents can be perfectly balanced.
10	Ant. Coupling Loop L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
11	SCREEN VOLTAGE (knob)	200 mA on Amplifier Plate Meters (Upper & Lower)	Rotate control clockwise until amplifier plate current meter reads 200 mA.
12	Final Amplifier Ant. Coupling Loop L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.

POWER AMPLIFIER ALIGNMENT (CONT'D)

STEP	ADJUSTMENT	METER READING	PROCEDURE
13	Grid Drive	Peak on Grid Current Meter	Turn plate tuning screw on Driver Amplifier for maximum reading. Insert the longer screwdriver end of tuning tool C into the plate cavity and adjust the output coupling loop for maximum grid current reading. CAUTION Do not insert metal screwdriver into output coupling loop hole.
14	Grid Tuning Controls C1 and C2	Amplifier Grid Meter Peak between 35 and 40 mA. NOTE: Adequate drive will still be obtained if reading drops to 18-20 mA with time.	Retune grid tuning controls, C1 and C2, for peak reading on amplifier grid meter. Reading should be between 35 and 40 mA.
15	CAUTION DO NOT ADJUST FOR MORE THAN 600 WATTS INPUT. (SEE STEP 10.) NOTE STEPS 8, 9, 10, 11, 12 AND 13 COMPRISE A SEQUENCE OF ADJUSTMENTS WHICH INTERACT UPON EACH OTHER. IF, UPON COMPLETION OF STEP 13 FINAL READINGS DO NOT AGREE WITH THE TABLE AT THE END OF THESE INSTRUCTIONS, REPEAT STEPS 8 THRU 13 TWICE MORE. IF CORRECT READINGS ARE STILL NOT OBTAINED, PROCEED TO CONCLUDING ADJUSTMENTS. PLATE TUNING CONTROL Z1 MUST BE ADJUSTED WITH SCREEN VOLTAGE AT MINIMUM (COUNTERCLOCKWISE). ANTENNA COUPLING LOOP L1 MUST BE ADJUSTED AFTER EACH ADJUSTMENT OF SCREEN VOLTAGE.		

CC4101C 600 WATT INPUT POWER TABLE		CC4101CF 550 WATT INPUT POWER TABLE
Plate Voltage (volts)	Plate Current Per Tube (milliamperes)	Plate Current Per Tube (milliamperes)
1800	165	153
1700	176	162
1600	187	172
1500	200	184
1400	214	196
1300	230	212
1200	250	228

CONCLUDING ADJUSTMENTS

1. Interaction between grid and plate circuits may require slight compensating adjustments of the PLATE TUNING control, Z1, as the GRID TUNING controls, C1 and C2, are adjusted. Increasing the grid current may decrease the plate current; decreasing the grid current increases the plate current. When finally adjusted, the plate power input should be a maximum of 300 watts for each amplifier tube as read on the two AMPLIFIER PLATE voltage and current meters.

ALIGNMENT CONTINUED ON BACK

2. If the grid current is less than 30 mA as read on the AMPLIFIER GRID meter, increase the rf drive from the driver station by adjusting the driver station OUTPUT COUPLING loop, L1, for increased reading on the AMPLIFIER GRID meter. Then readjust the AMPLIFIER GRID tuning controls for maximum AMPLIFIER GRID meter reading in the 35-40 mA range. Adjust controls to equalize readings on the two AMPLIFIER PLATE current meters as in step 8. POWER AMPLIFIER ALIGNMENT. With balanced readings readjust PLATE TUNING control, Z1, and COUPLING knob, L1, for maximum of 600 watts input.

3. If the grid current is more than 40 mA as read on the AMPLIFIER GRID meter, decrease the rf driver from the exciter by adjusting the driver station OUTPUT COUPLING loop, L1, for decreased reading on the AMPLIFIER GRID meter. Then readjust the AMPLIFIER GRID tuning controls for maximum AMPLIFIER GRID meter reading in the 35-40 mA range. Adjust controls to equalize readings on the two AMPLIFIER PLATE current meters as in step 8. POWER AMPLIFIER ALIGNMENT. With balanced readings readjust PLATE TUNING control, Z1, and COUPLING knob, L1, for maximum of 600 watts input.

4. If final readings on AMPLIFIER PLATE current meters cannot be brought up to full loading (600 watts), rotate the SCREEN VOLTAGE control clockwise.

NOTE

As tubes age and the power output drops it is possible to again increase this power output by increasing the screen voltage.

As tubes age further, the balancing of plate current may not be possible, however, if the imbalance is greater than 50 mA the tubes should be replaced.

CAUTION

DO NOT ADJUST TRANSMITTER FOR MORE THAN 600 WATTS POWER INPUT. POWER INPUT (WATTS) = PLATE VOLTAGE X TOTAL PLATE CURRENT (upper + lower AMPLIFIER PLATE meter readings)

FINAL METER READINGS

DRIVER STATION FINAL AMPLIFIER POSITION 6	DRIVER STATION FINAL AMPLIFIER POSITION 7	POWER AMPLIFIER GRID	POWER AMPLIFIER PLATE (UPPER)	POWER AMPLIFIER PLATE (LOWER)	POWER AMPLIFIER PLATE VOLTAGE
25-30	10-18	35-40	SEE 600 WATT INPUT POWER TABLE		

TUNING PROCEDURE FOR Z2 AND Z3

1. When to Tune Z2 and Z3. Z2 and Z3 are coarse tuning adjustments in the power amplifier plate current. They are used to bring the resonant point into the tuning range of the fine tuning control, Z1. When no dip can be found by tuning Z1 or when the dip is near the vertical or horizontal position of the tuning slot, Z2 and Z3 must be adjusted.

2. How to Locate Z2 and Z3

a. Turn HI-VOLTAGE switch OFF (accessible from the front of the cabinet).

b. Remove the two "Phillips" head screws on the right side of the power amplifier which hold the right side of the final amplifier to the mounting rack.

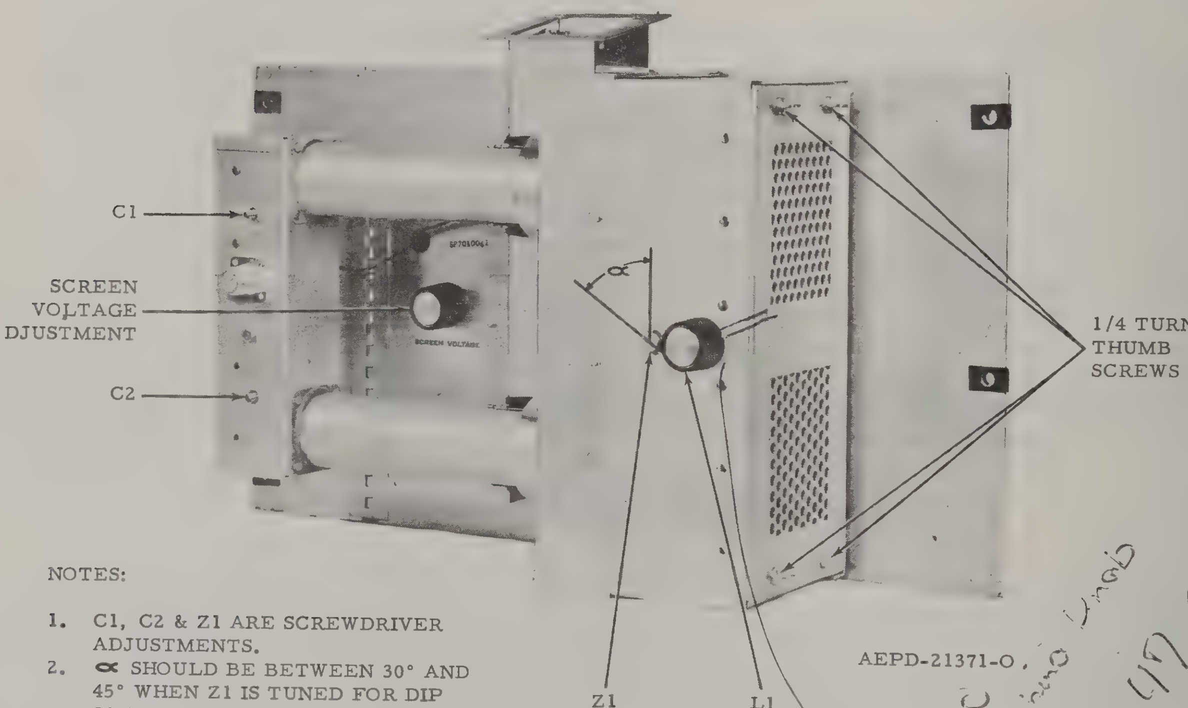
c. Open the rear door.

d. Swing the amplifier back on its hinges.

e. Release the four 1/4-turn thumb-screws which hold the cover plate on the side of the chassis and remove the plate to expose the end of the cavity.

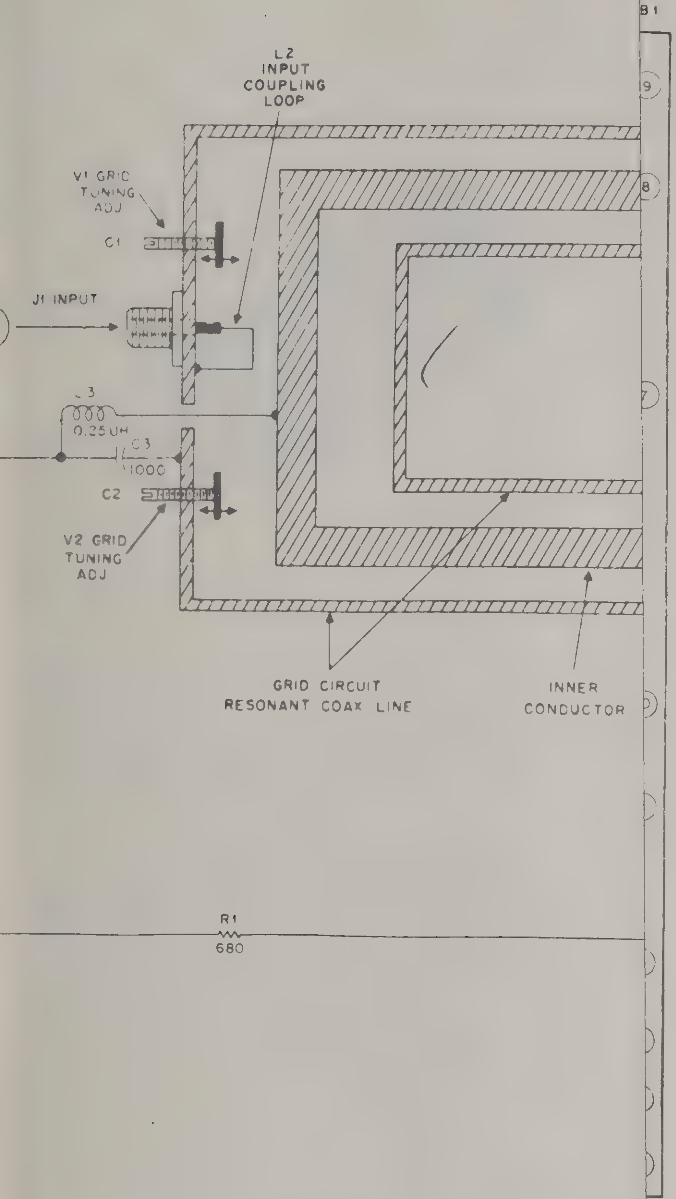
f. Z2 and Z3 are "U-shaped" shorting bars which slide toward and away from the center of the cavity. Z2 is the top bar, Z3 is the lower one.

3. <u>How to Tune Z2 and Z3.</u> Move BOTH shorting bars approximately 1/8-inch toward or away from the center of the cavity; Z2 and Z3 should always be set at equal distances from the center of the cavity. When Z1 dips the meter near the VERTICAL position, move Z2 and Z3 TOWARD the center of the cavity. When Z1 dips the meter near the HORIZONTAL position, move Z2 and Z3 AWAY FROM the center of the cavity. IF NO DIP IS FOUND when Z1 is tuned through its full range, it will be a matter of trial and error positioning of Z2 and Z3. Start with Z2 and Z3 positioned midway in their length of travel. It may be necessary to adjust the shorting bars four or more times before a dip reading falls within the tuning range of Z1. If the operating frequency is in the lower portion of the 450-470 MHz band, move the shorting bars away from the center of the cavity. If the transmitter is operating in the upper portion of the band, move the bars toward the center of the cavity. Replace the final amplifier chassis by reversing the procedure in step 2. Check the tuning of Z1. If Z1 still does not dip the meters as prescribed in step 3 of POWER AMPLIFIER ALIGNMENT, adjust Z2 and Z3 again until the proper dip is found, then go on to step 4 of POWER AMPLIFIER ALIGNMENT.

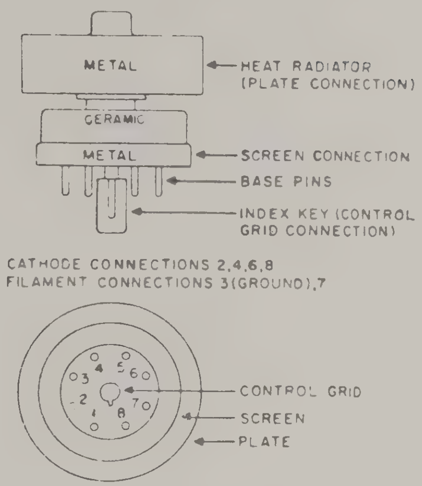


NOTES:

1. C1, C2 & Z1 ARE SCREWDRIVER ADJUSTMENTS.
2. α SHOULD BE BETWEEN 30° AND 45° WHEN Z1 IS TUNED FOR DIP READING.



4CX250B TUBE DETAIL



NOTES
1. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN UUF
2. AIR-FLOW INTERLOCK SWITCH S1 IS LOCATED IN THE AMPLIFIER AIR DUCT. IT PROTECTS THE FINAL AMPLIFIER TUBES IN CASE OF BLOWER FAILURE OR BLOCKAGE OF AIR.

POWER AMPLIFIER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

450-470 MHz, 250 & 275 Watt
Power Amplifier
Schematic Diagram
Motorola No. 63E81010E08-D
12/13/71-UP

c. Open the rear door.

d. Swing the amplifier back on its hinges.

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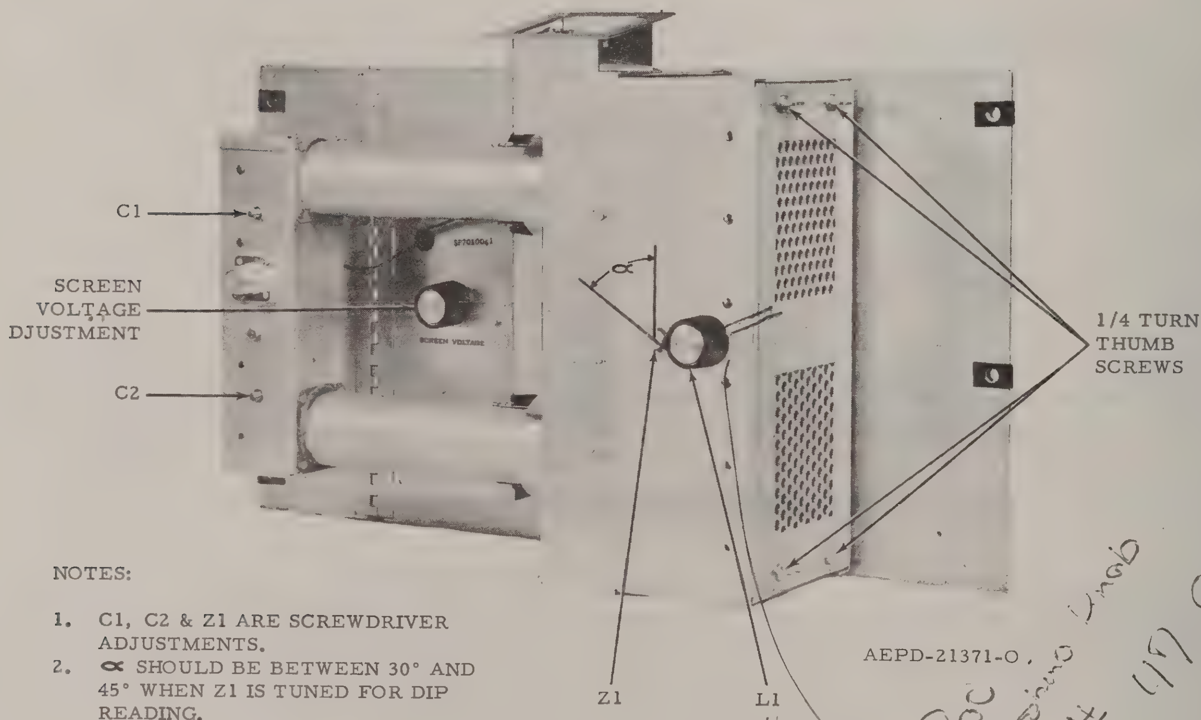

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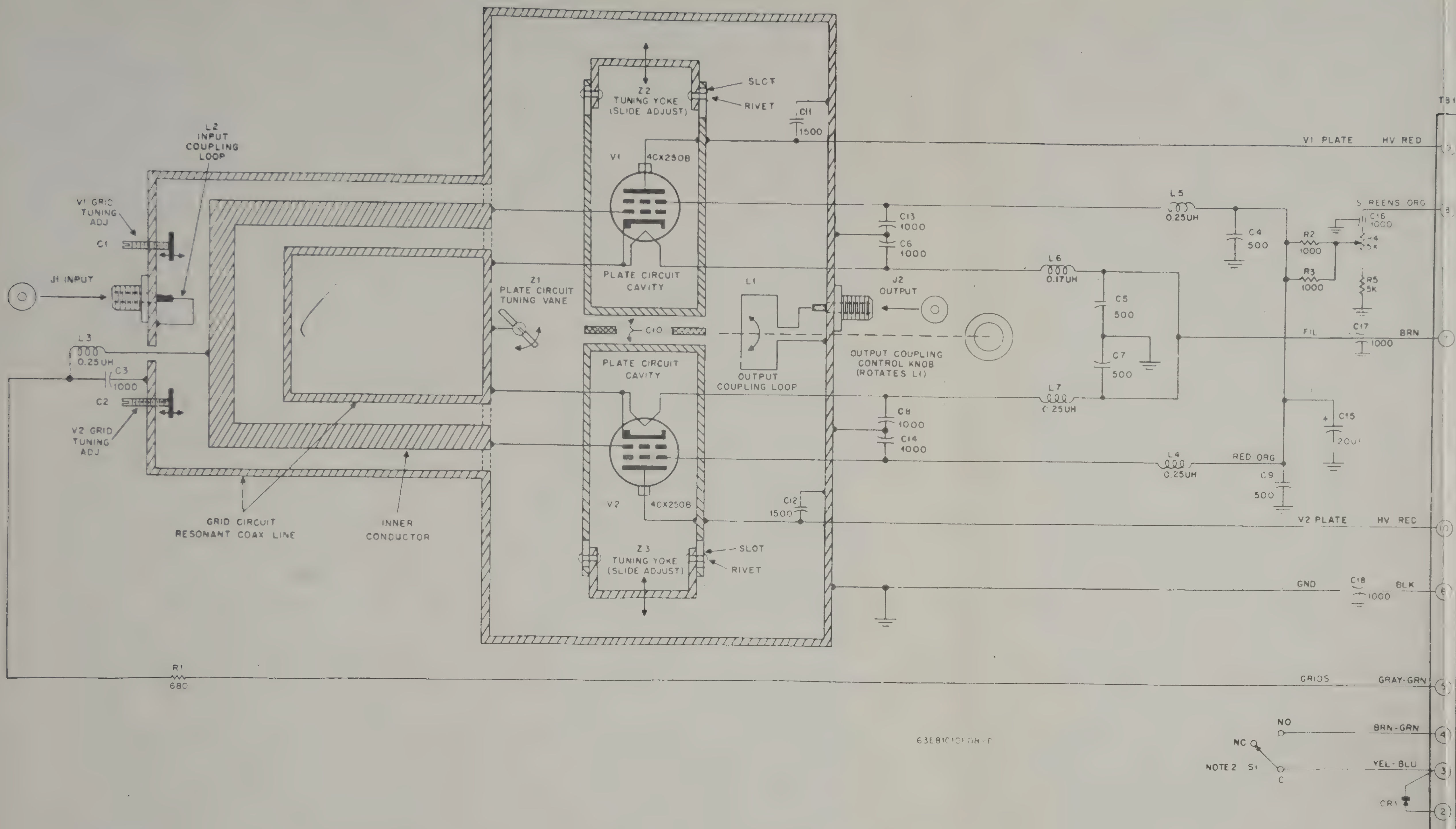
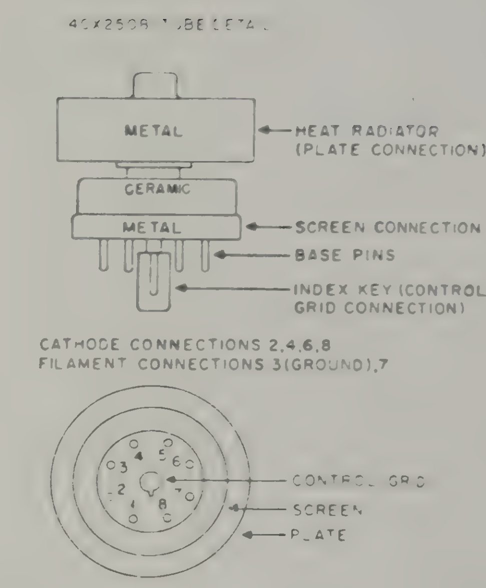




NOTES

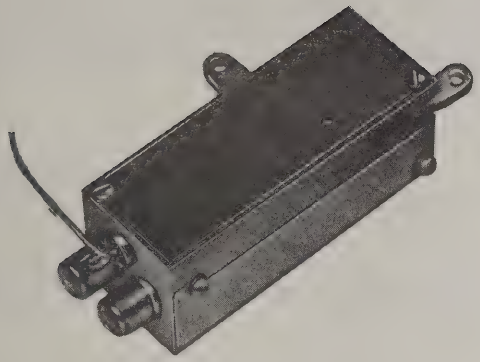
1. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN UUF
2. AIR-FLOW INTERLOCK SWITCH S1 IS LOCATED IN THE AMPLIFIER AIR DUCT. IT PROTECTS THE FINAL AMPLIFIER TUBES IN CASE OF BLOWER FAILURE OR BLOCKAGE OF AIR

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

450-470 MHz, 250 & 275 Watt
Power Amplifier
Schematic Diagram
Motorola No. 63E81010E08-D
12/13/71-UP

450-470 MHz PREAMPLIFIER

MODEL TLE1290A



AEPS-3083-O

1. DESCRIPTION

The preamplifier is a single stage grounded gate FET (field effect transistor) rf amplifier which connects between the antenna switch and receiver rf deck. It improves receiver sensitivity 6 dB from the specified receiver 20 dB quieting sensitivity of .5 microvolt.

The signal from the antenna is coupled directly into the input tuned-line of the preamplifier. This tuned-line passes the desired signal and matches the relatively low FET input impedance to the 50-ohm input line. The signal is capacitively coupled to the source terminal of the FET where it is amplified and then capacitively coupled to the output tuned-line. The output tuned-line is a high Q tank circuit. It passes the desired signal and matches the relatively high FET output impedance to the 50-ohm output line.

2. SERVICING

a. Unique Specifications and Measurements

The servicing procedure and most test readings for the receiver are the same with or without a preamplifier. Only the performance check specifications and "noise gain" measurements change with the use of the preamplifier. Refer to the instruction manual for test procedure information.

(1) Performance Checks

Check	Specification (microvolt or less) With Preamp	Specification (microvolt or less) Without Preamp
20 dB Quieting Sensitivity	.25	.5
"Private-Line" Squelch Sensitivity	.15	.25
Squelch Threshold Sensitivity	.15	.25
Full Squelch Sensitivity	.6	1.2

(2) "Noise Gain" Measurements

Only the "noise gain" measurements taken without a capacitor are changed when a preamplifier is used. All other measurements remain the same.

CAPACITOR CONNECTION POINT	TYPICAL VOLTMETER READING				"NOISE GAIN" (dB)	
	WITH PREAMP		WITHOUT PREAMP		WITH PREAMP	WITHOUT PREAMP
	mV	dBm	mV	dBm		
NONE	300	-7	100	-17	20	10

RF PREAMPLIFIER

MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

REVISIONS

63E81010E08-D

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
SP7010729	C15	WAS 23K837929, 5 uF	V2 GRID CIRCUIT
TLE1360A	CR1	ADDED	TB1-2 & -3

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TLE1360A Power Amplifier
(Formerly Model SP7010729)

PL-1025-B

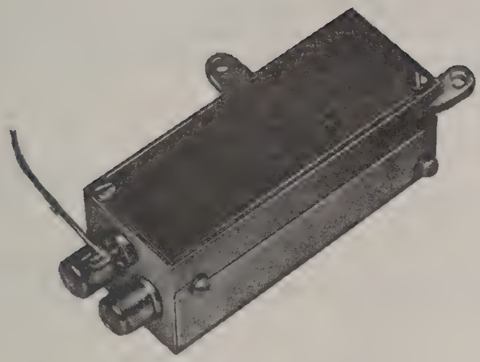
		CAPACITOR, fixed: unl. stated
C1, 2		adjustable; incl. 51A483511 PLATE & SCREW ASS'Y: used as one plate of adjustable capacitor
C3, 16, 17, 18	21B861219	1000 pF ±10%; 500 V
C4, 5, 7, 9	21A824948	500 pF +20-10%; 600 V
C6, 8, 13, 14	21B858836	1000 pF +100-0%; 500 V
C10		(SEE NOTE)
C11, 12	21C83289A03	1500 pF; 5K V
C15	23K483459	20 uF +50%-10%; 350 V
		SEMICONDUCTOR DEVICE, diode:
CR1	48C82466H18	silicon
		CONNECTOR, receptacle:
J1, 2	9A816159	female; coaxial; type N
		COIL, RF:
L1	24A852202	coupling loop
L2	1V80725A27	coupling loop
L3	24A852413	choke; 0.25 uH
L4, 5	24K821659	choke; 0.25 uH
L6, 7	24K810401	choke; .17 uH
		RESISTOR:
R1	17D82326B14	fixed: 680 ±5%; 5-1/4 W (Model TLE1360A only)
	SP7010061B	fixed: 680 ±5%; 5-1/4 W (Model SP7010729 only)
R2, 3	17B82177B21	fixed: 1K ±5%; 10 W
R4	18C82782H01	var; 5K ±10%; 25 W
R5	17C82177B22	fixed: 5K ±10%; 10 W
		SWITCH ASSEMBLY, air flow interlock:
S1	1A82354G01	incl. a spdt switch with attached actuator (air vane)
		TERMINAL BOARD:
TB1	31K80340	10 dual screw terminals does not incl. 13B82014G01 STRIP marker
		ELECTRON TUBE:
V1, 2	97T110A02	type 4CX250B
		SOCKET, tube; air cooled:
XV1, 2	9C82420E02	special construction; local type
		TUNING VANE:
Z1	58B852239	adjustable
		YOKE, tuning:
Z2, 3		slide adjustment for cavity tuning (SEE NOTE)
		NON-REFERENCED ITEMS
	36C82633H01	KNOB, control: used with L1, R4
	1V852520	COVER ASSEMBLY, PA cavity
	66A852458	EXTRACTOR tube: (for 4CX250B)

NOTE:

Field replacement of C10, Z2 and Z3 individually is not recommended. Replace only with 1V80711A08 Plate Line Section Assembly (includes C10, Z2, Z3).

450-470 MHz PREAMPLIFIER

MODEL TLE1290A



AEPS-3083-O

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The signal from the antenna is coupled directly into the input tuned-line of the preamplifier. This tuned-line passes the desired signal and matches the relatively low FET input impedance to the 50-ohm input line. The signal is capacitively coupled to the source terminal of the FET where it is amplified and then capacitively coupled to the output tuned-line. The output tuned-line is a high Q tank circuit. It passes the desired signal and matches the relatively high FET output impedance to the 50-ohm output line.

2. SERVICING

a. Unique Specifications and Measurements

The servicing procedure and most test readings for the receiver are the same with or without a preamplifier. Only the performance check specifications and "noise gain" measurements change with the use of the preamplifier. Refer to the instruction manual for test procedure information.

(1) Performance Checks

Check	Specification (microvolt or less)	
	With Preamp	Without Preamp
20 dB Quieting Sensitivity	.25	.5
"Private-Line" Squelch Sensitivity	.15	.25
Squelch Threshold Sensitivity	.15	.25
Full Squelch Sensitivity	.6	1.2

(2) "Noise Gain" Measurements

Only the "noise gain" measurements taken without a capacitor are changed when a preamplifier is used. All other measurements remain the same.

CAPACITOR CONNECTION POINT	TYPICAL VOLTMETER READING				"NOISE GAIN" (dB)	
	WITH PREAMP		WITHOUT PREAMP		WITH PREAMP	WITHOUT PREAMP
	mV	dBm	mV	dBm		
NONE	300	-7	100	-17	20	10

RF PREAMPLIFIER

MOTOROLA INC. Communications Division

ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

b. Localization of Receiver Malfunction to Preamplifier

Localization can be performed by either of the two following methods:

(1) Preamplifier Isolation

This method bypasses the preamplifier permitting receiver checks without the effects of the preamplifier. If the receiver checks are satisfactory without the preamplifier, the malfunction exists in the preamplifier.

Two methods may be used to bypass the preamplifier.

(a) Bypassing with Motorola Model PK472 Adapter Kit

This kit consists of three cables, any one of which may be used to facilitate bypassing as follows:

1. Male UHF Connector to Male Phono Plug

This cable may be used to connect a signal generator with a UHF female output connector directly to the rf deck input.

2. Male BNC Connector to Male Phono Plug

This cable may be used to connect a signal generator with a BNC female output connector directly to the rf deck input.

3. Female Phono Plug to Female Phono Plug

This cable may be used to connect together the two cables normally connected to the preamplifier.

(b) Bypassing Without Adapter Kit

If an adapter kit is not available, the rf cable from the antenna relay must be removed from the preamplifier and rerouted to the rf deck input. The signal generator cable can then be connected to the rf deck input through the radio set antenna receptacle. This may be performed as follows:

1. Disconnect the phono plug from the rf deck input and lay aside.

2. Disconnect the phono plug from the INPUT of the preamplifier and reconnect it to the rf deck input.

3. Connect the signal generator to the antenna receptacle.

The preamplifier is now bypassed and the receiver should meet all specifications and measurements as described for the receiver without a preamplifier. If the receiver is okay, remove and repair the preamplifier.

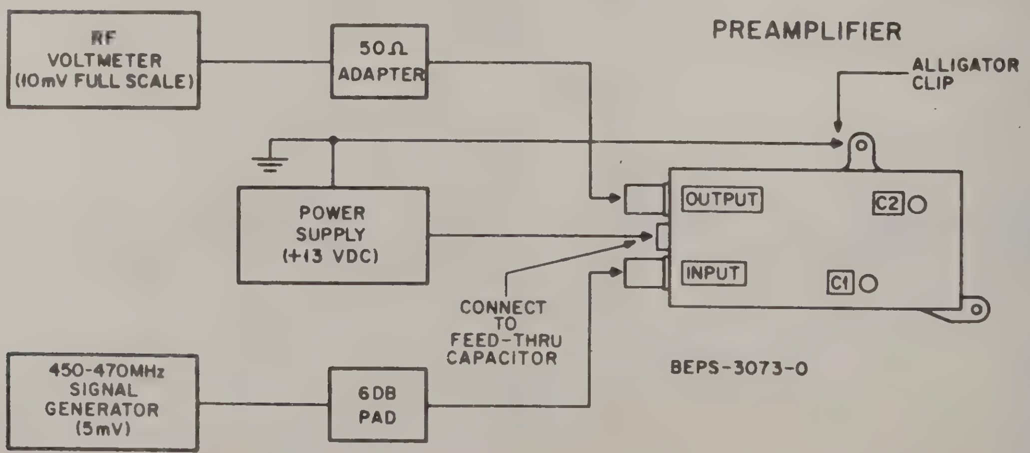
(2) Preamplifier Checks

This method permits checking of the preamplifier without checking the rest of the receiver.

(a) Test Equipment Required

1. Motorola Model S1318A Series Signal Generator, or equivalent.

2. Motorola Solid-State DC Multimeter, rf probe, and 50-ohm probe termination, or equivalent.



BEPS-3073-0

3. Motorola Model TEK-23 Regulated Power Supply, or equivalent.

4. Motorola Model PK472 Adapter Kit, or equivalent.

(b) Test Procedure

1. Connect the equipment as shown.

2. Adjust the power supply for 13 V dc.

3. Set the rf generator to the operating frequency.

4. Set the rf generator output attenuator to 5 millivolts.

5. Tune C2 on the preamplifier for a maximum reading on the multimeter.

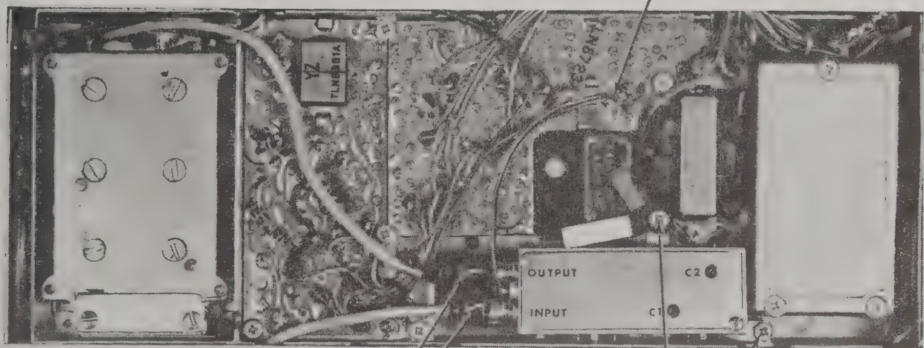
6. Tune C1 on the preamplifier for a maximum reading on the multimeter.

7. Repeat steps 5 and 6.

8. The voltmeter should now read 6.3 to 9.0 millivolts. If the correct reading is not obtained, retouch both capacitors for maximum reading. If the correct reading still cannot be obtained, remove and repair the preamplifier.

c. Removal of Preamplifier

Removal of the preamplifier is as shown in the following photo.



AEPS-3084-O

E	MOTOROLA PART NO.	DESCRIPTION

LIST

reamplifier Chassis PL-738-B

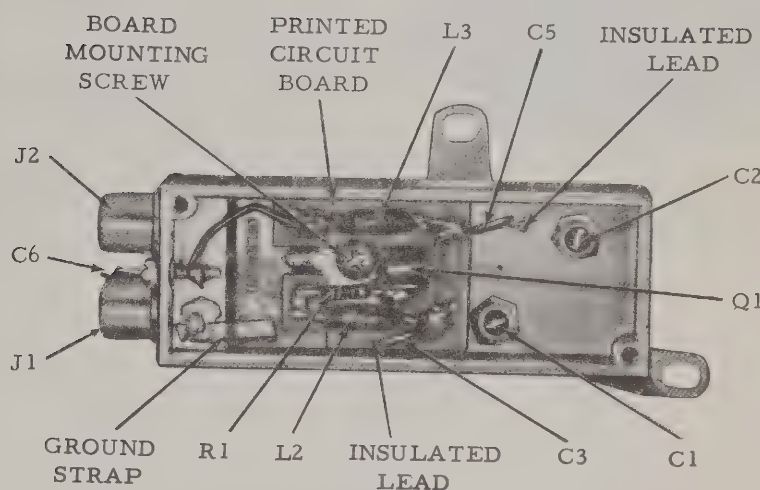
	21K861441	CAPACITOR, fixed; pF: unl. stated includes; 20C83693H01 CAPACITOR, variable; 0.8-6 and 76A84425B01 PISTON, tuning 500 ±10%; N4700
	21K861441	500 ±10%; N4700
	21B861219	.001 uF +100-0%; 500 V, coded RED
	9C84135B01	CONNECTOR, receptacle: female; single contact
	47B84330B01	COIL, RF: line input
	24A800484	choke, 0.31 uH
	24A800484	choke, 0.31 uH
	47B84330B03	line output
	48R869533	TRANSISTOR: (SEE NOTE) field-effect "N Channel" type M9533
	6S131524	RESISTOR, fixed: 100 ±10%; 1/4 W
	6S185B73	330 ±10%; 1/8 W
	NON-REFERENCED ITEMS	
	1V80708B85	CIRCUIT BOARD ASSEMBLY
	15B84322B01	COVER, top
	15B84323B01	COVER, side: 2 req'd.
	3S129481	SCREW, machine: #4-40 x 1/4" "Phillips" binder head
	15C84321B01	HOUSING, preamplifier
	14B82643E19	INSULATOR, Armite paper
	42B83660C01	CLIP, transistor mtg.
	76A84425B01	CORE, tuning: 2 req'd
	3S490352	SCREW, machine: No. 2-56 x 5/32" (cover mounting screws)

ardware and Cable Kit (Base Station)
A PL-762-A

	28B82331G01	CONNECTOR, plug: male; coaxial; miniature type
	1V80708B84	LINE, RF transmission: includes P1, P2 and 30B83794C01 CABLE, RF, coaxial; 11" length req'd. and 37S134371 SLEEVE, heat shrink; 2" length req'd.
	NON-REFERENCED ITEMS	
	42B84513B01	CLIP, channel element (insulated)
	43K24497	BUSHING, spacer: 1 used
	43K483672	BUSHING, spacer: 2 used
	3S136870	SCREW, tapping #4 x 1-1/8" "Phillips" hex head
	4S7555	WASHER, flat (.128-.250-.033)

ment diodes and transistors must be ordered
rola part number only for optimum performance.

TOP VIEW
(COVER PLATE REMOVED)



AEPS-4303-O

INPUT SIDE
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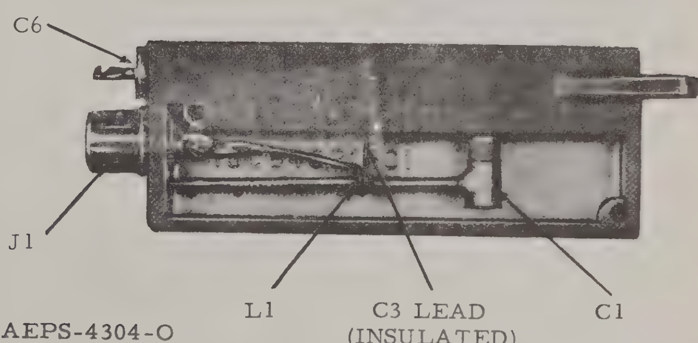


AEPS-4304-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLE6532A Preamplifier Chassis PL-738-B

		CAPACITOR, fixed; pF: unl. stated
C1, 2		includes; 20C83693H01 CAPACITOR, variable; 0.8-6 and 76A84425B01 PISTON, tuning
C3	21K861441	500 ±10%; N4700
C5	21K861441	500 ±10%; N4700
C6	21B861219	.001 uF +100-0%; 500 V, coded RED
		CONNECTOR, receptacle:
J1, 2	9C84135B01	female; single contact
		COIL, RF:
L1	47B84330B01	line input
L2	24A800484	choke, 0.31 uH
L3	24A800484	choke, 0.31 uH
L4	47B84330B03	line output
		TRANSISTOR: (SEE NOTE)
Q1	48R869533	field-effect "N Channel" type M9533
		RESISTOR, fixed:
R1	6S131524	100 ±10%; 1/4 W
R2	6S185B73	330 ±10%; 1/8 W
NON-REFERENCED ITEMS		
	1V80708B85	CIRCUIT BOARD ASSEMBLY
	15B84322B01	COVER, top
	15B84323B01	COVER, side: 2 req'd.
	3S129481	SCREW, machine: #4-40 x 1/4" "Phillips" binder head
	15C84321B01	HOUSING, preamplifier
	14B82643E19	INSULATOR, Armite paper
	42B83660C01	CLIP, transistor mtg.
	76A84425B01	CORE, tuning: 2 req'd
	3S490352	SCREW, machine: No. 2-56 x 5/32" (cover mounting screws)

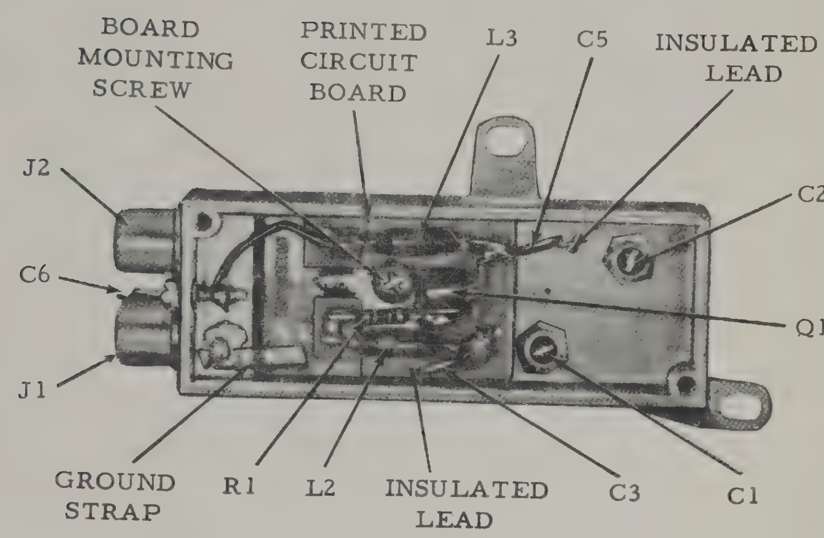
TLN4372A Hardware and Cable Kit (Base Station)
p/o TLE1290A PL-762-A

		CONNECTOR, plug:
P1, 2	28B82331G01	male; coaxial; miniature type
		LINE, RF transmission:
W1	1V80708B84	includes P1, P2 and 30B83794C01 CABLE, RF, coaxial; 11" length req'd. and 37S134371 SLEEVE, heat shrink; 2" length req'd.
NON-REFERENCED ITEMS		
	42B84513B01	CLIP, channel element (insulated)
	43K24497	BUSHING, spacer: 1 used
	43K483672	BUSHING, spacer: 2 used
	3S136870	SCREW, tapping #4 x 1-1/8" "Phillips" hex head
	4S7555	WASHER, flat (.128-.250-.033)

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TOP VIEW
(COVER PLATE REMOVED)



AEPS-4303-O

INPUT SIDE
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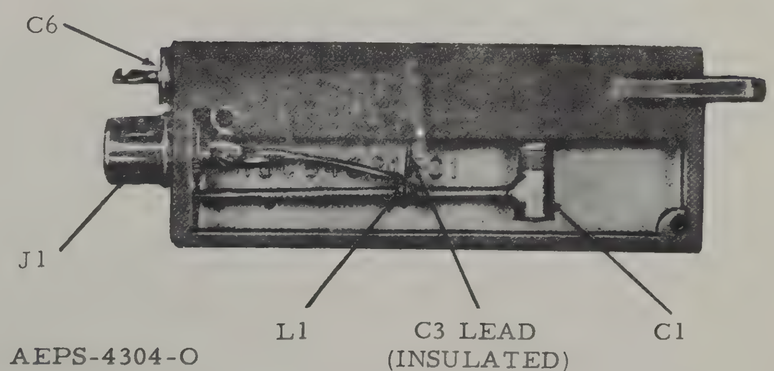

AEPS-4304-O

OUTPUT SIDE
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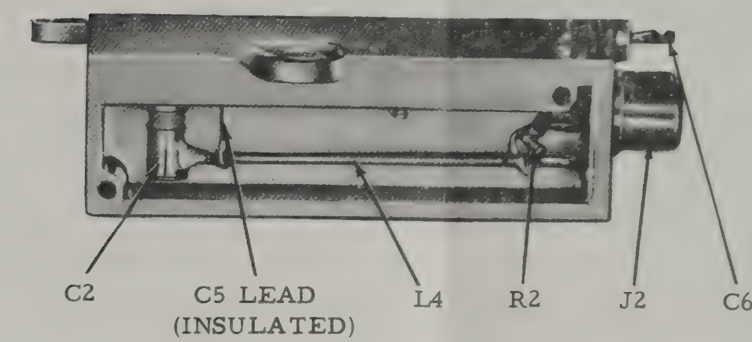
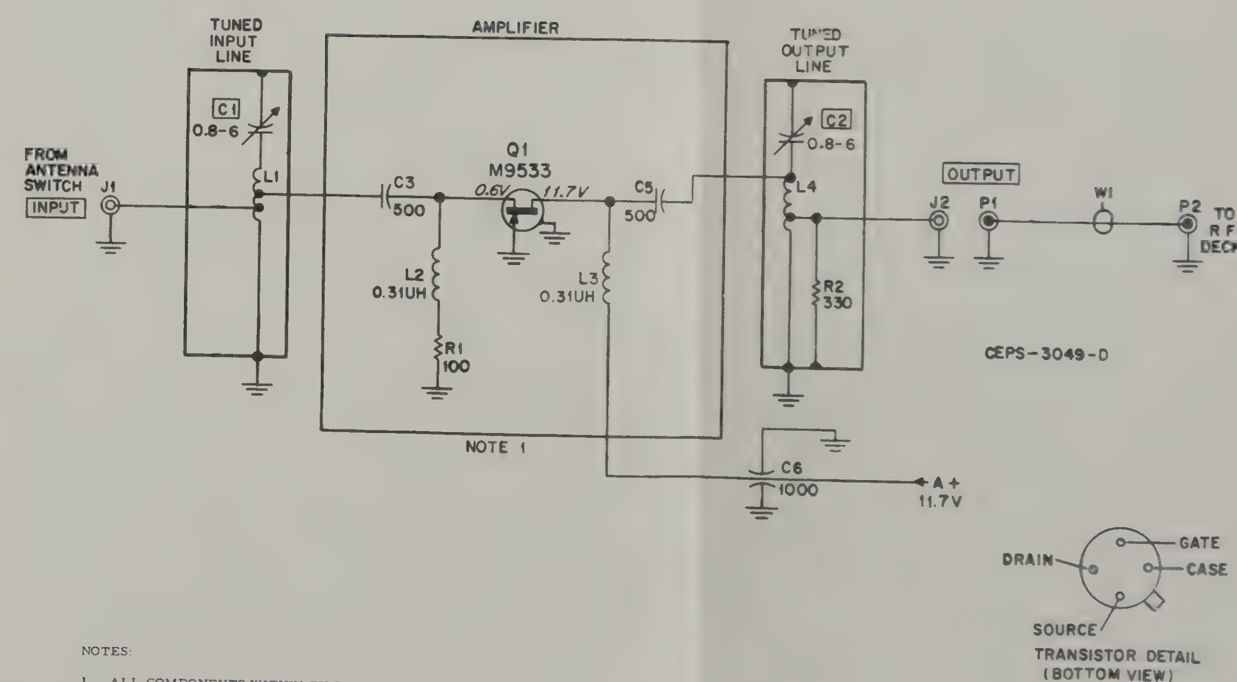


AEPS-4305-O



NOTES:

1. ALL COMPONENTS WITHIN THIS BOX ARE PHYSICALLY MOUNTED ON PRINTED CIRCUIT BOARD.
2. REFERENCES OUTLINED BY A RECTANGLE INDICATE MARKINGS ON CHASSIS.
3. ALL CAPACITOR VALUES ARE IN pF UNLESS OTHERWISE STATED.
4. ALL VOLTAGE READINGS MEASURED WITH A 20,000 OHM-PER-VOLT MULTIMETER.

MODEL TABLE

MODEL	SUFFIX	SUB-MODEL	SUFFIX	DESCRIPTION
TLE1290A		TLE6532A	1	PREAMPLIFIER
		TLN4372A		CABLE KIT

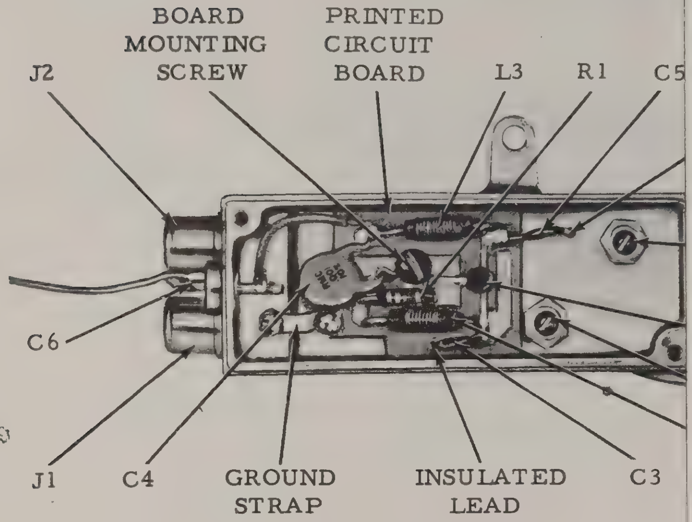
EPS-5624-O

LATER VERSION

RF PREAMPLIFIER

RF Preamplifier
Schematic Diagram
Motorola No. PEPS-5625-O
7/30/71-UP

TOP VIEW
(COVER PLATE REMOVED)



INPUT SIDE
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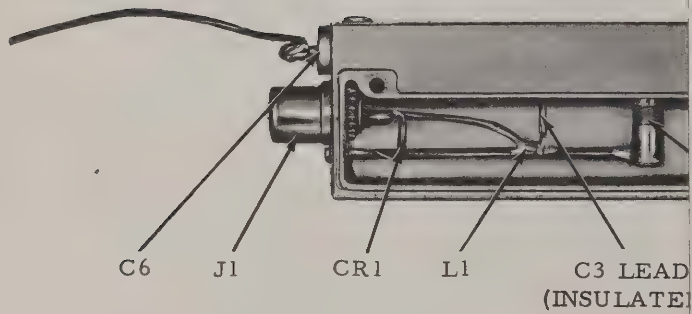


EARLIER VERSION

NOTES:

1. ALL COMPONI
ON PRINTED C
2. REFERENCES
ON CHASSIS.
3. ALL CAPACIT
4. ALL VOLTAGE
VOLT MULTIM

RF Preamplifier
Schematic Diagram
Motorola No. PEPS-5687-O
7/30/71

MODEL
TLE1290A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLE6532A Preamplifier Chassis PL-738

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; pF: unl. stated
C1, 2		includes; 20C83693H01 CAPACITOR, variable; 0.8-6 and 76A84425B01 PISTON, tuning
C3	21K861441	500 ±10%; N4700
C4	21C82187B20	1000 ±10%; 200 V
C5	21K861441	500 ±10%; N4700
C6	21B861219	.001 uF +100-0%; 500 V, cod RED
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48C83654H01	silicon
		CONNECTOR, receptacle:
J1, 2	9C84135B01	female; single contact
		COIL, RF:
L1	47B84330B01	line input
L2	24B864019	choke, 1.0 uH
L3	24B864019	choke, 1.0 uH
L4	47B84330B03	line output
		TRANSISTOR: (SEE NOTE)
Q1	48R869565	field-effect "N Channel" type M9565
		RESISTOR, fixed:
R1	6S131524	100 ±10%; 1/4 W
R2	6S185B73	330 ±10%; 1/8 W
	NON-REFERENCED ITEMS	
	15B84322B01	COVER, top
	15B84323B01	COVER, side: 2 req'd.
	3A82126B06	SCREW, Nylon: #4-40 x 1/4" slotted round head
	15C84321B01	HOUSING, preamplifier
	14B82643E19	INSULATOR, Armite paper

TLN4372A Hardware and Cable Kit
p/o TLE1290A PL-7

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, plug:
P1, 2	28B82331G01	male; coaxial; miniature type
		LINE, RF transmission:
W1	1V80708B84	includes P1, P2 and 30B83794C01 CABLE, RF, coaxial; 11" length req'd. an 37S134371 SLEEVE, heat shrink; 2" length req'd.
	NON-REFERENCED ITEMS	
	42B84513B01	CLIP, channel element (insulated)
	43K24497	BUSHING, spacer: 1 used
	43K483672	BUSHING, spacer: 2 used

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performanc

"SENSITRON" RECEIVER

MODEL TABLE

MODEL SERIES	DESCRIPTION
TRE1150AB	1-Frequency Carrier Squelch Receiver
TRE1150AD	Multi-Frequency Carrier Squelch Receiver
TRE1150AF	1-Frequency "Private-Line" Tone-Coded Squelch Receiver
TRE1150AH	Multi-Frequency "Private-Line" Tone-Coded Squelch Receiver
TLN1227A	Receiver 3rd & 4th Oscillator Assembly

1. DESCRIPTION

a. General

These receivers are fully transistorized, dual-conversion superheterodyne units that receive FM signals on one to four crystal-controlled frequencies. Multi-frequency receivers are the same as one-frequency units except for additional first oscillators and control circuits. In a multi-frequency receiver, only one frequency can be received at a time.

The one-frequency receivers can be used in local control or remote control stations. Receivers in local control stations are controlled from the local control panel and the audio output is applied to the speaker. Receivers in remote control stations are controlled by dc line currents or tone bursts from the remote control point and the audio output is applied to a 600-ohm audio line which carries the audio to the remote control point. Operating voltages for the receiver are supplied by the base station power supply. A metering receptacle is provided for monitoring the various stages of the receiver for test and alignment purposes.

The "Private-Line" receivers incorporate a tone controlled squelch circuit that normally controls the receiver. The normal carrier noise activated squelch circuit is used for monitoring purposes. A switching lead is brought out from the receiver to control the monitor function. When this lead is grounded by the control circuit, only the tone controlled squelch circuit operates. Thus, the receiver output is heard only when the incoming rf carrier is modulated by the appropriate continuous tone. When the operator presses the MONITOR key on the remote control console (or operates the "Private-Line" disable switch on local control stations) the control circuits open the ground connection on this lead, activating the noise squelch circuit. Any on-frequency signal may now be heard.

b. Two-Frequency Operation

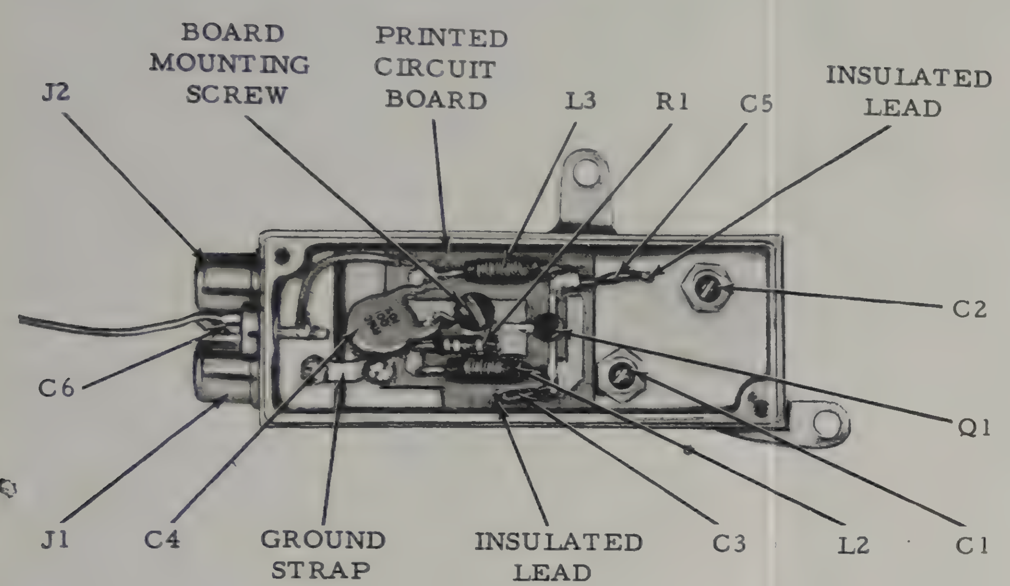
Some base station models contain two complete single-frequency receivers. When two single-frequency receivers are employed, each receiver will receive one specific frequency. Both receivers are identical.

The audio from both receivers is applied to the 600-ohm audio line output for remote control stations, or to the speaker for local control stations. If both receivers are in operation simultaneously, receiver No. 2 can be muted from the remote control point by applying a dc control current or tone bursts on the line or operating a receiver No. 2 mute switch on the local control panel.

RECEIVER

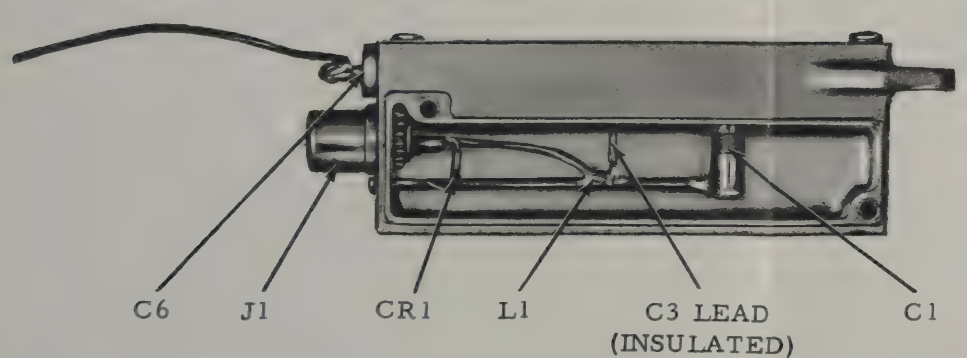
MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

TOP VIEW
(COVER PLATE REMOVED)



AEPS-3080-O

INPUT SIDE
(COVER PLATE REMOVED)



AEPS-3081-O

EARLIER VERSION

OUTPUT SIDE
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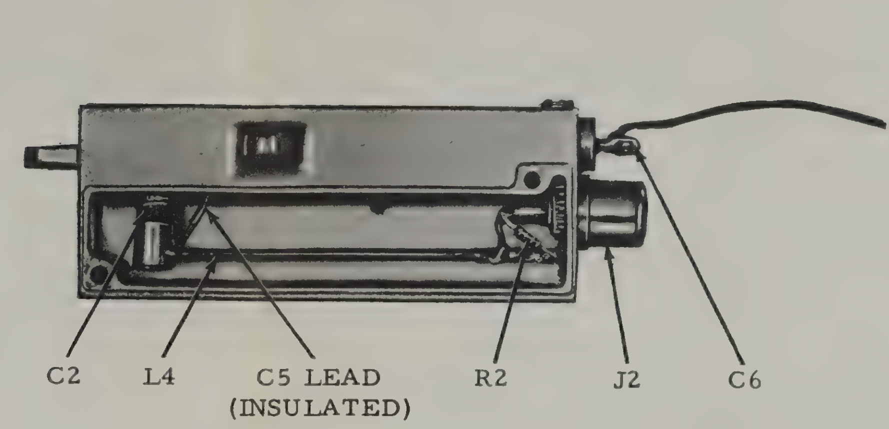
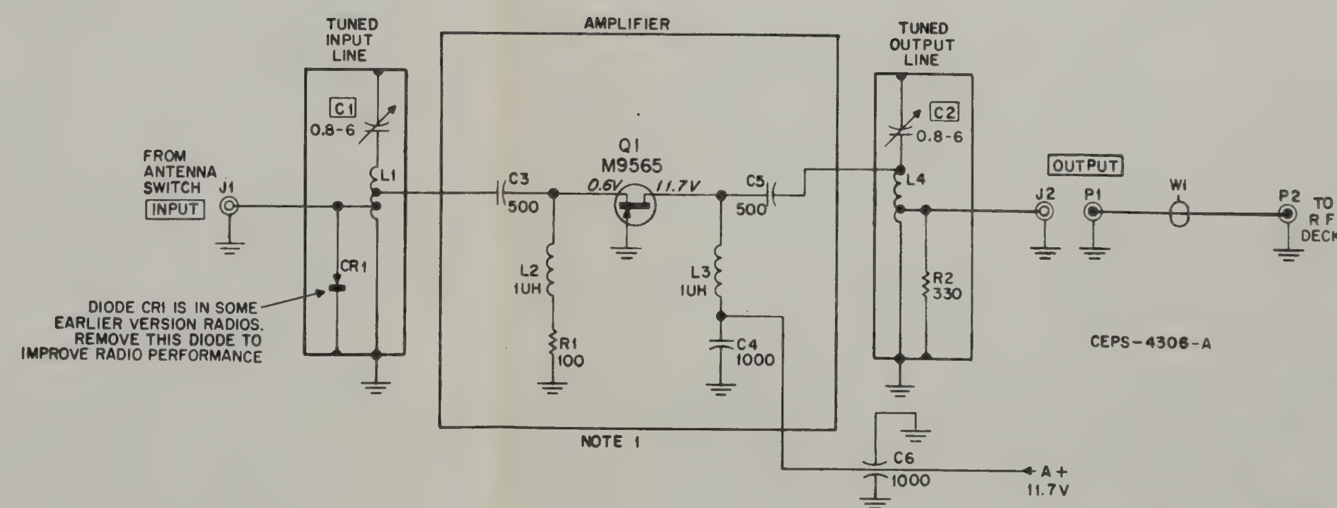
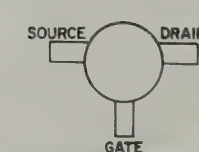


AEPS-3082-O



CEPS-4306-A



TRANSISTOR DETAIL

NOTES:

1. ALL COMPONENTS WITHIN THIS BOX ARE PHYSICALLY MOUNTED ON PRINTED CIRCUIT BOARD.
2. REFERENCES OUTLINED BY A RECTANGLE INDICATE MARKINGS ON CHASSIS.
3. ALL CAPACITOR VALUES ARE IN pF UNLESS OTHERWISE STATED.
4. ALL VOLTAGE READINGS MEASURED WITH A 20,000 OHM-PER-VOLT MULTIMETER.

MODEL TABLE

MODEL	SUFFIX	SUB-MODEL	SUFFIX	DESCRIPTION
TLE1290A		TLE6532A	1	PREAMPLIFIER
		TLN4372A		CABLE KIT

EPS-5624-O

PARTS LIST

TLE6532A Preamplifier Chassis PL-738-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; pF: unl. stated
C1, 2		includes; 20C83693H01 CAPACITOR, variable; 0.8-6 and 76A84425B01 PISTON, tuning
C3	21K861441	500 ±10%; N4700
C4	21C82187B20	1000 ±10%; 200 V
C5	21K861441	500 ±10%; N4700
C6	21B861219	.001 uF +100-0%; 500 V, coded RED
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48C83654H01	silicon
		CONNECTOR, receptacle:
J1, 2	9C84135B01	female; single contact
		COIL, RF:
L1	47B84330B01	line input
L2	24B864019	choke, 1.0 uH
L3	24B864019	choke, 1.0 uH
L4	47B84330B03	line output
		TRANSISTOR: (SEE NOTE)
Q1	48R869565	field-effect "N Channel" type M9565
		RESISTOR, fixed:
R1	6S131524	100 ±10%; 1/4 W
R2	6S185B73	330 ±10%; 1/8 W
NON-REFERENCED ITEMS		
	15B84322B01	COVER, top
	15B84323B01	COVER, side: 2 req'd.
	3A82126B06	SCREW, Nylon: #4-40 x 1/4" slotted round head
	15C84321B01	HOUSING, preamplifier
	14B82643E19	INSULATOR, Armite paper

TLN4372A Hardware and Cable Kit
p/o TLE1290A PL-762-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, plug:
P1, 2	28B82331G01	male; coaxial; miniature type
		LINE, RF transmission:
W1	1V80708B84	includes P1, P2 and 30B83794C01 CABLE, RF, coaxial; 11" length req'd. and 37S134371 SLEEVE, heat shrink; 2" length req'd.
NON-REFERENCED ITEMS		
	42B84513B01	CLIP, channel element (insulated)
	43K24497	BUSHING, spacer: 1 used
	43K483672	BUSHING, spacer: 2 used

NOTE:

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RF PREAMPLIFIER

RF Preamplifier
Schematic Diagram
Motorola No. PEPS-5687-O
7/30/71

"SENSITRON" RECEIVER

MODEL TABLE

MODEL SERIES	DESCRIPTION
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TLN1227A	Receiver 3rd & 4th Oscillator Assembly

1. DESCRIPTION

a. General

These receivers are fully transistorized, dual-conversion superheterodyne units that receive FM signals on one to four crystal-controlled frequencies. Multi-frequency receivers are the same as one-frequency units except for additional first oscillators and control circuits. In a multi-frequency receiver, only one frequency can be received at a time.

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MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

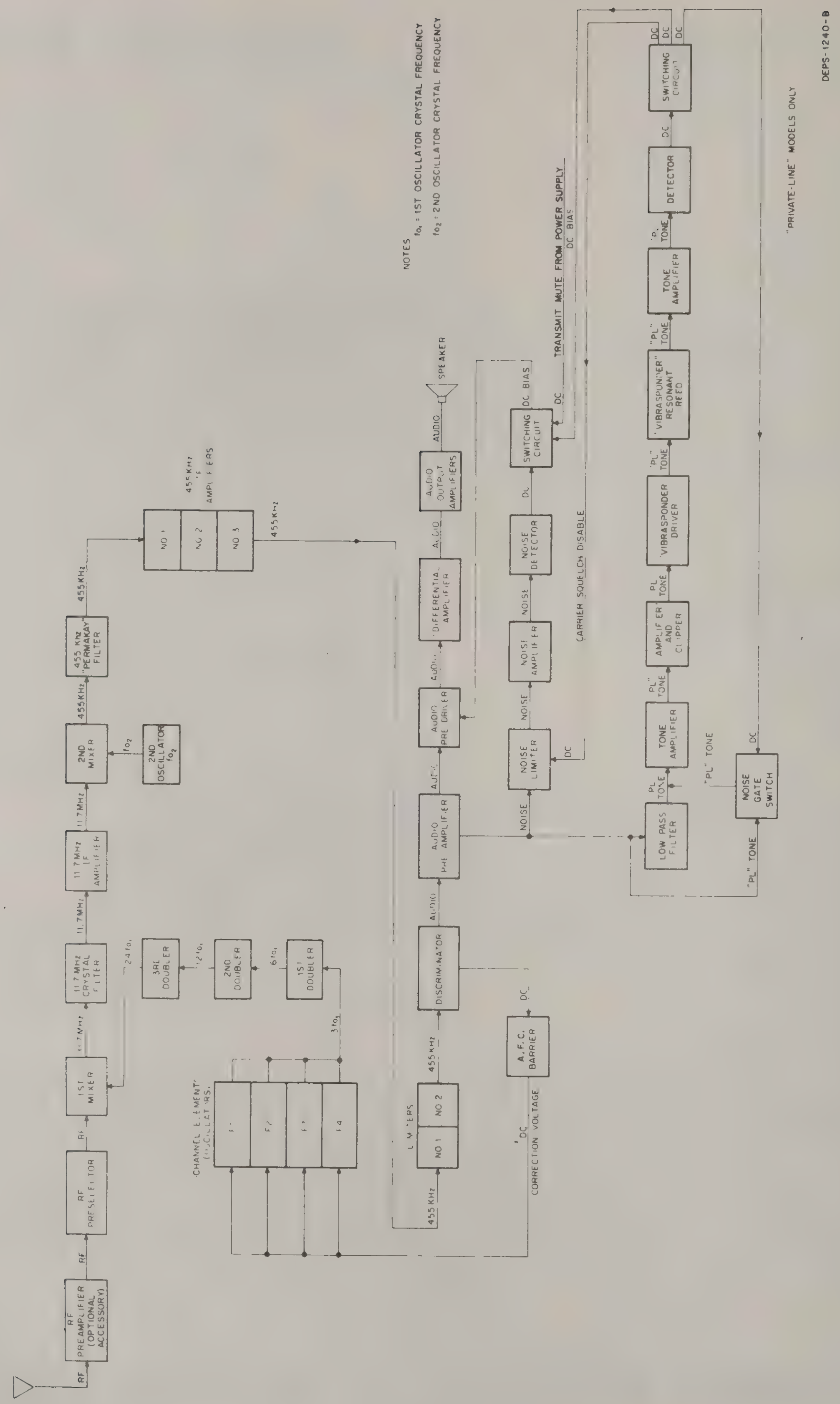


Figure 1.
Receiver Block Diagram

2. CIRCUIT DESCRIPTION

a. RF Preselector

The rf signal received at the antenna is routed to the preselector stage. The preselector has a flat acceptance bandwidth and a steep skirt response to provide rapid attenuation of signals outside the accepted bandwidth. Capacitive and magnetic coupling are used to couple the signal through the resonant cavity apertures. The preselector contains six low-loss, highly selective, helical resonant cavities (L1 through L6).

b. First Oscillator-Multiplier

The first oscillator circuit may contain up to four channel elements. Oscillator selection is accomplished by grounding the appropriate circuit (F1, F2, F3 or F4). On single-frequency units, the oscillator stage is permanently grounded.

The channel element is a factory-sealed, temperature-compensated, plug-in module with an oscillator using an unheated crystal in a Colpitts circuit. The output of the oscillator is tuned to the third harmonic by a double-tuned circuit (L14 and L15) on the multiplier board. A variable "warp" capacitor, mounted in the channel element base, is accessible through an opening in the circuit board for fine frequency adjustment.

The third harmonic of the crystal frequency is applied to a 1st doubler circuit (Q5) producing an output of six times the crystal frequency. The second and third doublers (Q6 and Q7) raise the frequency to 24 times the crystal frequency prior to injection to the 1st mixer stage. Coils L14 and L15 are tuned to the third harmonic of the fundamental crystal frequency; L16 is tuned to six times the crystal frequency; L17 and L18 are tuned to 12 times the fundamental frequency; L19, L20 and L21 (Hi-Q aperture coupled coils) are tuned to 24 times the crystal frequency.

Oscillator noise and harmonics are attenuated by coils L19 through L21 before the injection signal is applied to the source lead of field-effect transistor Q1 (first mixer stage).

c. Voltage Regulator and Current Regulator

The receiver voltage regulator (CR6 and CR7) provides a constant 9.5 volts dc to the 1st oscillator (channel element) and the three doubler stages (Q5, Q6 and Q7) of the multiplier circuit. By applying a constant voltage to these critical circuits, frequency and injection stability are maintained. Current regulator Q8 provides a constant total current to zener diode CR6 in the voltage regulator and the multiplier board. This current regulation assures a constant voltage supply for the 1st oscillator and multiplier circuits, under a wide range of possible variations in the A+ supply.

Current regulator Q8 functions as a variable resistance in series with the Zener current path of CR6, which also includes diode CR7 and resistor R31. The 8.8-volt zener voltage of CR6, added to the voltage across forward-biased diode CR7 (approximately 0.7 volt), develops a stable voltage of 9.5 volts across the two diodes (in series). If the A+ voltage should start to decrease, the voltage change (applied via diodes CR9 and CR8) drives the base of P-N-P transistor Q8 in the negative direction, increasing its forward base-to-emitter bias. The collector current of Q8 increases, causing a decrease in its effective collector-to-emitter resistance. This causes a decrease in the total resistance in the "zener current" circuit, which includes R31, the emitter-to-collector path of Q8, zener diode CR6 and diode CR7. The decrease in resistance in the "zener current path" compensates for the decrease in A+ voltage, so that the actual zener current of CR6 remains unchanged.

d. First Mixer

Signals from the rf preselector and multiplier circuits are applied to the first mixer transistor (Q1). This N-channel field-effect transistor functions as a depletion-mode device. The elements of the FET are: the gate (G) which controls the electrostatic field in the channel through which electrons must flow (similar to the grid of a vacuum tube); the source (S) which is similar to the cathode; and the drain (D) which is similar to the plate.

As the dc drain-source voltage is applied, current flows in the channel of Q1 and through resistor R1. The current flowing through resistor R1 develops a reverse bias voltage for Q1 between the source and gate elements. This reverse bias permits Q1 to operate below the "pinch off"

current of the FET. In this square law operating region, heterodyne action occurs to produce an intermediate frequency (i-f) of 11.7 MHz.

In two-receiver base stations where the rf carrier frequencies are separated by 5.85 MHz ±50 kHz or 11.7 MHz ±50 kHz, the i-f of the second receiver is shifted from 11.7 MHz to 11.6 MHz. The formulas used to calculate the high i-f frequencies of both receivers are stated as follows:

$$f_c - 24\,f_1 = 11.7 \text{ MHz or } 11.6 \text{ MHz}$$

rf carr. input	mult. factor	1st osc. freq.	non-shifted 1st i-f (Rcvr #1)	shifted 1st i-f (Rcvr #2)

NOTE: If a shift of high i-f frequency is required in a two-receiver station, it will be the higher (rf) frequency receiver whose i-f frequency is shifted from 11.7 to 11.6 MHz.

NOTE

In "second receivers", the shifted i-f is used only when rf carrier separation is 5.85 MHz ±50 kHz, or 11.7 MHz ±50 kHz.

e. First Intermediate Frequency (High IF) Circuit

The output from the 1st mixer (Q1) is coupled through a crystal filter to a common emitter high i-f amplifier circuit (Q2). Resonant circuit L8, two crystals (Y1 and Y2), and tuned transformer T1 are used in a crystal filter circuit. This provides highly selective filtering for high i-f interference rejection.

The output of the i-f amplifier is coupled to the base of the second mixer circuit (Q3) through a highly selective triple-tuned network consisting of T2, L10 and L11.

f. Second Oscillator

Crystal-controlled 2nd oscillator Q4 provides the local oscillator signal required for the second conversion in this dual-conversion receiver. Either "low-side" or "high-side" injection is provided for the 2nd mixer, by selection of the proper crystal frequency for this oscillator. Selection of either low-side or high-side injection is determined by the operating frequency of the receiver, in order to minimize the susceptibility of the receiver to spurious responses or self-quieting.

(1) In single-receiver stations or in the majority of two-receiver stations, the 2nd oscillator crystal frequencies are as follows:

For low-side injection, the operating frequency of crystal Y3 is 11.245 MHz;

For high-side injection, the operating frequency of crystal Y3 is 12.155 MHz.

NOTE

The 1st i-f frequency in these receivers is 11.7 MHz.

(2) In the higher frequency receiver in a two-receiver station with 5.85 MHz ±50 kHz or 11.7 MHz ±50 kHz separation the 2nd oscillator crystal frequencies are as follows:

For low-side injection, the operating frequency of crystal Y3 is 11.145 MHz;

For high-side injection, the operating frequency of crystal Y3 is 12.055 MHz.

NOTE

The 1st i-f frequency in these receivers is 11.6 MHz.

The output signal from the emitter of 2nd oscillator Q4 is coupled via capacitor C26 to the base of 2nd mixer Q3.

g. Second Mixer

Second mixer Q3 heterodynes the output signal of high i-f amplifier Q2 with the output signal of 2nd oscillator Q4 to produce a difference frequency of 455 kHz. This is the "low i-f" or "second intermediate frequency". A common-emitter circuit is used, with the i-f and oscillator signals both fed into the base of Q3.

In the collector circuit of Q3, the difference frequency of 455 kHz is coupled through a narrow-bandpass ("Permakay") filter, Z1, which rejects all other frequencies present.

The second i-f frequency (455 kHz) is calculated as follows:

(1) "Unshifted i-f" Receivers:

High-Side Injection		Low-Side Injection
12.155 MHz (2nd osc.)		11.700 MHz (1st i-f)
-11.700 MHz (1st i-f)	OR	-11.245 MHz (2nd osc.)
.455 MHz (455 kHz)		.455 MHz (455 kHz)

(2) "Shifted i-f" Receivers:

High-Side Injection		Low-Side Injection
12.055 MHz (2nd osc.)	OR	11.600 MHz (1st i-f)
-11.600 MHz (1st i-f)		-11.145 MHz (2nd osc.)
.455 MHz (455 kHz)		.455 MHz (455 kHz)

h. 455 kHz "Permakay" Filter

Filter Z1, located between the output of the 2nd mixer stage (Q3) and the input to the 1st 455-kHz amplifier stage (Q301), is the major factor in determining the bandwidth and selectivity of the receiver. It greatly attenuates all signals below and above a pre-determined bandpass. The filter is permanently sealed in polyesterstyrene and is unconditionally guaranteed for the life of the receiver provided the seal is not broken and the housing is not tampered with.

i. 455 kHz Second Intermediate Frequency (Low i-f Amplifiers)

The output signal from filter Z1 is applied to the base of 1st 455-kHz amplifier Q301. It is amplified by three i-f amplifiers (Q301, Q302 and Q303), each with approximately 30 db gain. These stages are RC-coupled, "forced gain" amplifiers, which provide sufficient output to drive the limiters into full clipping, even with only front-end noise present as an input signal.

Built-in metering points (meter positions 1 and 2) are provided for measuring relative signal levels at the outputs of 2nd and 3rd 455-kHz amplifiers.

j. Limiter Stages

Two limiter stages (Q304 and Q305) are used to improve the signal-to-noise ratio. These stages remove amplitude variations from the received signal. The limiters are in full saturation at all times (weak signals, strong signals, or receiver noise). When the 1st limiter (Q304) receives the negative alternation of the incoming signal, the base is driven negative with respect to the emitter, consequently, the base-emitter junction is reverse biased, causing the collector current to decrease. On the positive half of the incoming signal, the base-emitter junction is forward biased, causing the collector current to increase to maximum. The operation of the second limiter stage is essentially the same as the first limiter except for phase reversal. Q304 and Q305 operate between cut-off and saturation, removing amplitude variations from received signals.

k. Discriminator

The discriminator circuit translates frequency variations of the 455-kHz signal into audio information.

Operation of the circuit is dependent upon a 90° phase shift which occurs (at resonance) between the primary and secondary voltages of the tuned transformer (T3). As a signal is applied to the discriminator, the resonant circuit phase shift appears capacitive or inductive depending upon the frequency applied to diodes CR303 and CR304 (early versions used transistors Q306 and Q307 functioning as diodes). These diodes produce a null (zero volts) at the output of the discriminator at resonance.

An unmodulated input signal exactly 455 kHz produces a null (zero volts) at the output of the discriminator. When modulation is applied, the i-f signal varies in frequency (at the audio rate) above and below 455 kHz. A positive or negative voltage is produced at the output of the discriminator for deviation above or below 455 kHz, resulting in an audio signal at that point (see Figure 2). The discriminator output is developed at the cathode of CR303 (collector of Q306) with respect to the cathode of CR304 (collector of Q307) (ground). The audio signal is coupled from the output of the discriminator through filter choke L302 to the preamplifier on the audio & squelch circuit board.

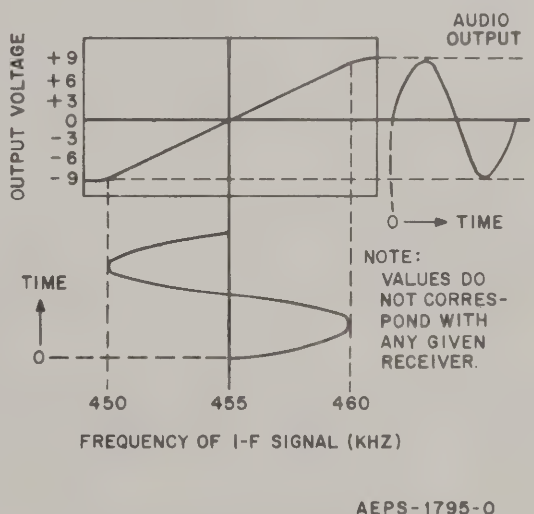


Figure 2.

l. Automatic Frequency Control (AFC)

The automatic frequency control circuit provides automatic frequency adjustment to compensate for carrier frequency or receiver frequency drift.

When an off-frequency condition is detected by the discriminator, a dc error voltage is produced. This positive or negative error voltage is filtered by R329, R30, C326, C51 and C49. The filtered correction voltage is applied to the channel element to adjust the oscillator frequency in the direction of the received carrier frequency. A diode barrier circuit (CR4 and CR5) protects the receiver from being "pulled" onto the adjacent channel.

m. Audio Stages

The output of the discriminator is capacitively coupled to preamplifier stage Q341. This stage provides a 4 dB gain with a low output impedance. The collector output is applied to (1) the receiver volume and squelch controls and (2) the "Private-Line" decoder. The audio signal from the volume control is routed to a filter which removes the "PL" tone from the audio signal before it is applied to pre-driver stage Q342. In the unsquelched state, the stage is forward biased and in the squelched condition, a reverse bias exists between the emitter and the base. When a signal is received, Q342 is forward biased to allow signals to pass.

In local control stations and repeaters without wire line control, the audio output of the pre-driver stage is applied directly to the differential drivers Q343 and Q344. In remote control stations and repeaters with wire line control, the audio from the pre-driver is applied to the 600-ohm line via the remote control unit. An amplified sample of that audio is returned to the differential drivers for providing a speaker output during testing and maintenance.

A differential amplifier with one transistor in a common base and another in a common emitter configuration is used. Common emitter stage Q343 drives common base amplifier Q344 in a push-pull operation.

The power amplifier (audio output) consists of a pair of transistors in a push-pull arrangement to provide 5 watts of audio power to a 3.2-ohm speaker.

n. Noise Actuated Squelch Circuit

The squelch circuit eliminates disturbing noise which would otherwise be heard at the speaker during intervals between received messages. A noise voltage from the squelch control is applied to the noise limiter, noise amplifier and noise detector stages. The dc output of the noise detector controls a switching stage which turns the pre-driver stage on or off.

When a signal is received, the absence of noise causes the switching transistor (Q350) to stop conducting, which allows the pre-driver stage to conduct. The receiver squelch action occurs as a result of emitter-base bias of the pre-driver stage. Forward bias allows the audio signal to pass through the audio amplifier stages and the speaker (unsquelched).

The operation of switch transistor Q350 depends upon the base voltage. Noise coming from the squelch control provides forward bias for the switch transistor. In the absence noise, switch Q350 does not conduct. When the switch transistor is not conducting, the current through R384 is small, as a result, the voltage appearing at the emitter of Q342 becomes more positive (higher than the base voltage); the transistor becomes forward biased and the stage operates normally (unsquelched).

Noise voltages normally present in the receiver have sufficient amplitude to drive the noise limiter stages to saturation and produce full conduction at the noise detector. Thus, squelch action is positive. Carrier squelch or noise-actuated squelch sensitivity is adjustable. The squelch control, located between the output of the audio preamplifier and the input to the noise limiter, determines the noise level into the limiter and the conduction level at the detector.

o. Tone-Coded Squelch Circuit

The "Private-Line" ("PL") decoder circuit consists of a low-pass filter network, a high-gain amplifier, an amplifier/clipper, a "Vibrasponder" driver stage, a "Vibrasponder" resonant reed, an output amplifier, a detector, an output switch stage, and a noise gate switch.

The output from the audio preamplifier is connected to the low-pass filter network, which passes frequencies below 300 Hz. The low-frequency signals ("PL" tone) are amplified by Q751 and coupled to the input of the amplifier/clipper Q752. The output of the amplifier/clipper is applied to the "Vibrasponder" driver stage to drive the resonant reed. After being detected and amplified, the "PL" tone energizes the resonant reed. If a different tone is present, or if no tone is present, the reed will not respond due to its highly selective design. The output from the "Vibrasponder" driver is applied to the resonant reed coil through an emitter-follower

circuit. The reed is permanently tuned and sealed at the factory.

The reed vibrates in response to the incoming tone signal. The vibrating reed produces a sinusoidal output which is amplified by Q754 and detected by Q755. The detected output is applied to the output switch (Q756) which provides a dc voltage that reverse biases the squelch switching transistor (Q350), turning it off.

The low-pass "PL" filter is paralleled by a high pass filter circuit to keep low frequency noise from activating the "Vibrasponder" resonant reed detector circuit. When the proper tone signal is received and the audio pre-driver stage is turned on, the high-pass path is shorted to ground through the noise switch (Q350).

In "Private-Line" operation, the squelch control is not used and the setting of it does not affect the "Private-Line" squelch circuit. With the "PL" disable switch not operated only the tone-coded squelch circuit is in operation. When the carrier squelch circuit is disconnected from the audio preamplifier, the squelch switching transistor (Q350) receives its control voltages from the noise switch (Q757). Switch Q350 is forward biased until a proper tone-coded signal is received. Switch Q757 then provides a positive voltage to Q350. This reverse biases Q350. With less current through the emitter resistor (R384), forward bias is applied to the pre-driver stage (Q342) allowing it to conduct and pass the audio signal to the speaker.

The "PL" squelch circuit is operative at all times. The "PL" disable switch actually switches the noise squelch circuit in or out. With the "PL" disable switch unoperated the noise-actuated squelch circuitry is inhibited and the noise detector will not disable the switching transistor to permit audio to reach the speaker. Only an output from the "Private-Line" decoder will operate the switching transistor.

With the "PL" disable switch operated, the inhibit input to the noise-actuated squelch circuit is removed and the switching transistor operates from the noise-actuated or "Private-Line" tone-coded squelch circuits.

3. MAINTENANCE

a. General

Malfunctions in the receiver can be localized by using the optional built-in station metering kit or connecting a Motorola portable test set to the receiver metering receptacle and making stage measurements. The meter readings may be compared to the values listed in the charts, but preferably, a log of readings should be maintained for reference. Each new set of readings should then be compared to previous readings. An abrupt change in a meter reading indicates a circuit failure while a gradual change in a reading may indicate an impending failure which can be corrected before operation becomes marginal.

b. Receiver Priority

Stations with two receivers may have the optional receiver priority feature added. Local control stations can use a busy light kit for receiver #1 priority. Two busy light kits can be used for first come-first served priority, or priority can be given to receiver #1 or receiver #2. Remote control stations can use a receiver #1 priority kit. With these kits, an incoming signal on a receiver mutes the other receiver.

c. Recommended Test Equipment

Servicing and troubleshooting will be effective and efficient only if the proper test equipment is used and used properly. Test equipment must also be calibrated periodically to maintain its accuracy. The following items of test equipment should be considered a minimum for "Compa-Station" receiver servicing.

(1) Built-in station metering or Motorola S1056A-9A Portable Test Set with TEK-11 Audio Adapter and TKN6025A Adapter Cable.

(2) Motorola Solid-State AC Voltmeter, or equivalent. This meter has 10 megohms input impedance shunted by 15 pF in the 1- to 300-volt range and 1 megohm input impedance shunted by 30 pF in the 1- to 300-millivolt range and is calibrated in voltage and db scales.

(3) Motorola Solid-State DC Multimeter with rf probe, or equivalent. This meter has 11 megohms input impedance.

(4) Motorola Model S1318A or S1319A FM Signal Generator, or equivalent, with TEK-10 RF Injection Probe.

(5) Motorola Model TEK-1A Transistorized Tone Generator, Model S1067A Transistorized Audio Oscillator, or equivalent (1000 and 400 Hz output for adjusting and testing receiver audio stages).

(6) Motorola Model SLN6221A "Private-Line" Tone Generator (generates "PL" tone for servicing "Private-Line" tone-coded squelch receivers).

(7) Motorola Model TEK-7A RF/DC Alignment Meter (or SLN6055A RF Probe for use with solid-state dc multimeter) for making receiver stage gain measurements.

(8) Motorola Model T1015A General Purpose Oscilloscope or S1301A Solid-State Oscilloscope or equivalent.

d. Performance Checks

The following checks give an indication of overall receiver performance. The checks may be used in troubleshooting to determine the need for repairs or alignment and should always be performed upon completion of servicing to guarantee that proper operation of the receiver is fully restored.

Insert a carrier signal directly into the antenna input jack and make the following checks:

NOTE

If the signal is injected through a 6 dB pad, subtract 6 dB from the attenuator reading for the actual signal level.

(1) 20 dB Quieting Sensitivity Check

The 20 dB quieting sensitivity should be 0.5 microvolt or less. The following procedure may be used to measure the 20 dB quieting sensitivity.

(a) Unsquelch the receiver and disable the receiver "Private-Line" function. "PL" disable can be accomplished by the momentary contact switch or by connecting TB1-1 in the junction box to chassis ground with a test lead.

(b) Connect the FM signal generator to the receiver antenna jack through a 6 dB pad. Set the signal generator to the receiver frequency, then turn the output down to minimum.

(c) Measure the receiver audio output with a solid-state ac voltmeter or equivalent. The measurement of noise can be taken across TB1-6 and -7 in any station except a repeater or wire line controlled station that does not have a local speaker. In that case a 3.2-ohm resistor or a 3.2-ohm speaker must be connected to TB1-6 and -7. The volume is controlled by R #1 LINE OUTPUT control in repeaters, LOCAL SPEAKER LEVEL in wire line control stations, and the VOLUME control on local control base stations. Adjust the receiver volume for a convenient meter reading such as 1 volt.

(d) Increase the output of the signal generator until the meter reading is 1/10th of that in step (c) (i.e., 20 dB below that in step (c)) making sure that the signal generator is exactly on-frequency. (The noise level decreases as the rf input to the receiver increases.)

(e) Read the setting on the signal generator output control and subtract 6 dB for the pad. This value in microvolts is the 20 dB quieting sensitivity of the receiver, which should be no greater than 0.5 microvolts.

(2) "Private-Line" Squelch Sensitivity Check

The "Private-Line" squelch sensitivity should be 0.25 microvolt or less. It may be measured as follows:

Make sure the station is not "PL" disabled (including the squelch gate jumper in repeaters). Connect a local speaker if one is not on the station to monitor the receiver audio.

Externally modulate the rf output of the signal generator with a "Private-Line" tone of the proper frequency to unsquelch the receiver at ±0.5 to 1 kHz deviation. The "Private-Line" tone can be generated by using a Motorola SLN6221A Transistorized "Private-Line" Tone Generator and the "Vibrasender" resonant reed from the power supply of the radio set or by using a Motorola S1067A Transistorized Audio Oscillator and adjusting it to the "Private-Line" tone frequency. The tone frequency to be used is indicated on the "Vibrasponder" resonant reed in the receiver. Set the signal generator output level to zero and increase the level until the receiver unsquelches (noise is heard in the speaker). Take the reading from the attenuator of the signal generator. No more than 0.25 microvolt should be required to cause the receiver to unsquelch.

(3) Carrier Squelch Threshold Sensitivity Check

The squelch threshold sensitivity should be 0.25 microvolt or less. It may be measured as follows:

Disable the "Private-Line" function. Connect a local speaker if one is not on the station to monitor the receiver audio. If the station has

two receivers, turn the other receiver's squelch control maximum clockwise. With no signal input, set the SQUELCH control so the noise just quiets (squelch threshold). Modulate the rf output of the signal generator with a 1000-Hz tone to produce a deviation of ±3.3 kHz. Set the signal generator output to zero and increase the level until the tone is heard in the speaker. Take the reading from the attenuator of the signal generator. No more than 0.25 microvolt should be required to open the squelch.

(4) Full Squelch Sensitivity Check

The full squelch sensitivity should be 1.25 microvolts or less. It may be measured exactly as the squelch threshold sensitivity except that the SQUELCH control is turned fully clockwise. No more than 1.25 microvolt should be required to open the squelch.

e. Test Set Readings

Use the built-in metering kit or connect a Motorola Portable Test Set and TKN6025A Adapter Cable to the receiver metering receptacle and set the function selector switch to the RCVR position. With no signal input, typical readings are as shown in Table 1.

NOTE

On multi-frequency models, check the readings on each frequency.

f. "Noise Gain" Measurements

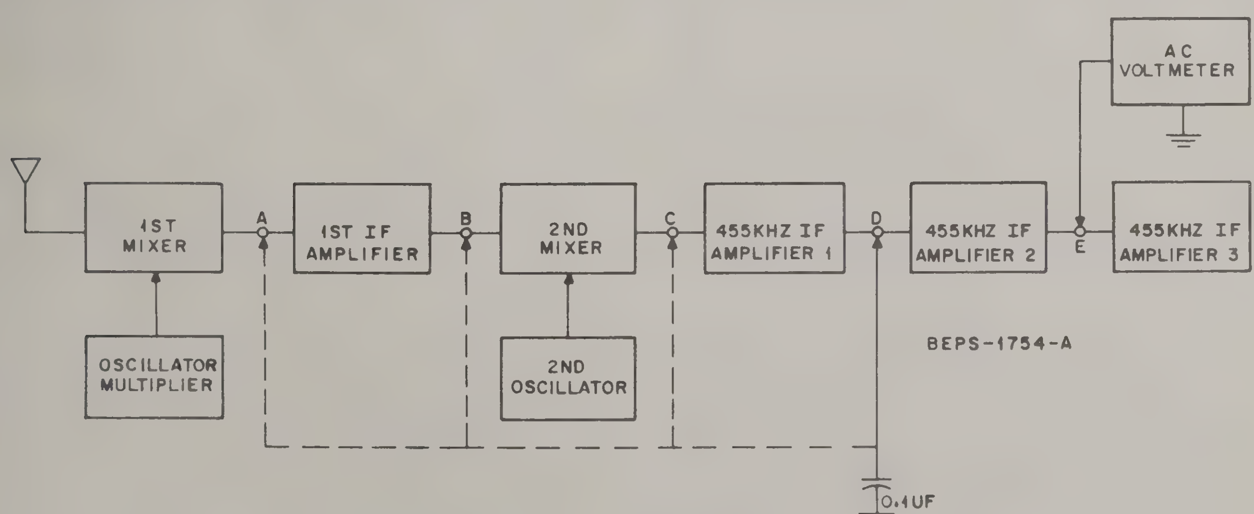
If the receiver has no meter reading or an abnormal meter reading in position 1, the "noise gain" check is a quick method of locating major malfunctions in the rf stages. This method will not locate misalignment or low rf gain, but will tell whether a stage is operative or inoperative.

Essentially, the "noise gain" check is a signal tracing method of troubleshooting. An ac voltmeter is connected at the base of Q11, then the input signal of each previous stage, in turn, is shorted to ground by a capacitor, starting at Q10 and working toward the antenna. Each additional stage should provide more noise which will be read on the voltmeter. A stage which produces no increase in noise or significantly less gain than listed in the table is defective. If this method does not locate the defective stage, perform the oscillator checks and stage gain measurements as listed in the following paragraphs.

The "noise gain" measurements may be performed as shown in Figure 3 and the results

TABLE 1.
RECEIVER METERING READINGS (NO SIGNAL APPLIED)

Built-In Meter Selector Switch Position	Portable Test Set Metering Switch Position	Stage	Typical Reading (Microamps)
R1	1	455 kHz IF Amp (Q302)	2.0
R2	2	455 kHz IF Amp (Q303)	23
R·4, R-4	4	Discriminator Output	±2
R5	5	Base of 1st Dblr. (Q5)	25
R6	6	Base of 2nd Dblr. (Q6)	18



RECEIVER

TABLE 2.
TYPICAL "NOISE GAIN" MEASUREMENTS

CAPACITOR CONNECTION POINT	TYPICAL VOLTMETER READING		"NOISE GAIN"	
			STAGE	GAIN
Q10 Collector	4.8 mV	-44 dBm		
Q9 Collector	7.7 mV	-40 dBm	Q10	4 dB
Q3 Collector	12 mV	-36 dBm	Q9	4 dB
Q2 Collector	26 mV	-29 dBm	Q3	7 dB
Q1 Drain	35 mV	-27 dBm	Q2	2 dB
None	100 mV	-17 dBm	Q1	10 dB

evaluated by comparing the readings obtained with the typical values listed in Table 2.

g. Oscillator Checks

(1) 1st Oscillator

(a) Connect a Motorola Portable Test Set to the receiver metering receptacle. Check position 5 (oscillator activity). If there is no reading or a low reading (18 uA is typical minimum reading) proceed to step (b). If the reading is normal, proceed to step (c).

(b) Measure the rf voltage with a Motorola Solid-State DC Multimeter with rf probe at pin 1 of the channel element. A normal reading of approximately 1.7 volts rf should be obtained. Make voltage and resistance checks to locate the defective component.

(c) Measure the rf voltage with a Motorola Solid-State DC Multimeter with rf probe at the source of the 1st mixer Q1. A normal reading of at least 0.3 volt rf should be obtained. Make voltage and resistance checks to locate the defective component.

(2) 2nd Oscillator

Measure the rf voltage with a Motorola Transistorized DC Multimeter at the emitter of the 2nd oscillator (Q4) or the base of the 2nd mixer (Q3). A normal reading of 0.10 volt rf should be obtained. Make voltage and resistance checks to locate the defective component.

h. Stage Gain Measurements

Simple troubleshooting procedures such as transistor substitution into a suspected stage may tell little about the source of trouble. Because transistors are current devices with negative temperature co-efficients damage can occur when soldering or unsoldering. A different approach to troubleshooting transistorized circuits must be used. The defective section must first be isolated through stage gain measurement before any attempt is made to locate and replace the defective component. When the defective section has been isolated, the defective stage can be determined by voltage and resistance checks which can also isolate the defective component.

A typical stage-by-stage checkout follows. Individual stage gains may vary somewhat from the typical values given if overall gain is maintained. The amplifiers must be kept out of saturation to present a true presentation of gain. Do not use signal levels higher than indicated in the following procedures.

(1) RF Deck

(a) Connect the portable test set to the receiver metering receptacle, place the function selector in the RCVR position, and place the selector switch in position 1.

(b) Using the FM signal generator and TEK-10 RF Probe, inject a carrier frequency signal at the rf input receptacle of the receiver chassis. Adjust the signal generator output level for a reading of 10 microamperes on the test set meter. Note the signal level in db on the attenuator of the signal generator.

(c) Move the TEK-10 RF Probe to the output of the rf deck (drain of Q1) and inject a carrier frequency signal. Increase the output level of the signal generator until the test set meter again reads 10 uA. Note the attenuator settings in db.

(d) The apparent gain should be at least 55 dB; that is the reading in step (c) should be at least 55 dB greater than the reading in step (b).

NOTE

If a reading cannot be obtained on the test set meter, inject a 455-kHz signal

NOTE (Cont'd)

into the 3rd 455-kHz amplifier so that a reading is obtained and into each stage progressing toward the antenna until the defective stage is found.

(2) 11.7-MHz IF Circuit

(a) Connect the signal generator to the rf input receptacle of the receiver chassis. Set the signal generator to the receiver frequency.

(b) Place the TEK-7A RF/DC Alignment Meter switch in the .5 V RF position and the probe RF/DC switch in the RF position.

OR

Use a Motorola Solid-State DC Multimeter with an rf probe and place the range selector switch in the .3 VOLT position.

(c) Place the rf probe of the meter at the input to the 11.7-MHz i-f circuit board (WHT lead to L8) and adjust the signal generator output level for an indication of 5 uA (.05 volt) on the alignment meter, or 0.3 volt if a dc multimeter is used. Note the setting of the attenuator in db on the signal generator.

(d) Move the rf probe of the meter to the output of the 11.7-MHz i-f circuit board (BRN) lead from the collector of Q3 and again adjust the signal generator for an indication of 5 uA on the alignment meter, or 0.3 volt on the multimeter. Again note the setting of the attenuator in dB.

(e) The gain should be at least at 16 dB; that is the reading in step (c) should be at least 16 dB greater than the reading in step (d). If the gain is low, the following steps may be performed to further isolate the trouble.

(f) Using the same procedure that was used in steps (a) through (d), move the rf probe to each of the following points and readjust the output level of the signal generator for an alignment meter indication of 5 uA or multimeter indication of 0.3 volt at each point. Take readings from the attenuator of the signal generator.

Point of Measurement	Typical Gain or Loss
Base of 11.7-MHz IF Amplifier Q2	5 dB less than input to circuit board
Collector of 11.7-MHz IF Amplifier Q2	12 dB greater than base of Q2
Collector of 2nd Mixer Q3	15 dB greater than collector of Q2

(3) 455-kHz "Permakay" Filter

(a) Set up the signal generator and the alignment meter or dc multimeter as described for the 11.7-MHz IF Circuit in the preceding paragraph.

(b) Place the rf probe at the input to the 455-kHz i-f filter (BRN lead to the i-f circuit board) and adjust the signal generator level for an indication of 5 uA on the alignment meter or 0.3 volt on the dc multimeter. Note the setting of the attenuator in dB.

(c) Move the rf probe of the meter to the output of the 455-kHz i-f filter and readjust the signal generator so that the meter gives the same indication as in step (b). Again note the setting of the attenuator in db.

(d) The gain should be 29 dB; that is, the reading in step (b) should be 29 dB greater than the reading in step (c). If the gain is abnormally low, the filter is defective.

(4) 455 kHz IF Amplifiers 1 and 2

(a) Leave the signal generator connected to the rf input receptacle of the receiver chassis and adjusted to the receiver carrier frequency.

(b) If the TEK-7A RF/DC Alignment Meter is used, set the range selector switch to the 5 V RF position and the switch on the probe to the RF position. If the Solid-State DC Multimeter and rf probe are used, set the range selector switch to the 1 VOLT position.

(c) Place the rf probe of the meter at the input to the 455-kHz i-f amplifier circuit board (BRN lead at the base of Q301) and adjust the level of the signal generator for 5 uA (0.5 volt) on the alignment meter or 0.5 volt on the multimeter. Note the setting of the attenuator in dB.

(d) Move the rf probe of the meter to the base of 455-kHz i-f amplifier #3 (Q303) and readjust the signal generator level so that the meter gives the same indication as in step (c).

(e) The gain should be at least 53 dB; that is, the reading in step (c) should be at least 53 dB greater than the reading in step (d). If the gain is low, the individual gain of each stage may be checked as given in the following step.

(f) Move the rf probe to the base of 455-kHz i-f amplifier #2 Q302 and readjust the signal generator for the same indication on the

meter that was obtained in steps (c) and (d). The gain of Q301 should be 26 dB; that is, the reading should be 28 dB less than the reading in step (c). The gain of Q302 should be 27 dB; that is, the reading for this step should be 27 dB greater than the reading in step (d).

(5) 455-kHz IF Amplifier 3 and Limiters

Due to the saturation condition of the remaining 455-kHz i-f stages, further stage gain measurements are not applicable. Measurements may be made with a Motorola Solid-State AC Voltmeter or equivalent. Typical value with no receiver signal input are as follows:

3rd 455-kHz i-f amplifier collector (Q303)	1.5 Vac
1st 455-kHz i-f limiter collector (Q304)	1.6 Vac
2nd 455-kHz i-f limiter collector (Q305)	5.5 Vac

(6) Audio Circuit Checks

(a) Connect the TEK-11 Audio Adapter between the portable test set and the TKN6025A Adapter Cable, then connect the adapter cable to the receiver metering receptacle. Place the function selector switch in the RCVR position, and the selector switch in position 11.

(b) Set the volume or line output control on the control unit to minimum (full counterclockwise) and disable the "PL" (a test lead from TB1-1 to ground will disable the "PL").

(c) Inject a 1000-Hz tone from a Motorola TEK-1A Transistorized Tone Generator at the "input from discriminator" lead to the audio and squelch circuit board (GRN-RED lead from 455-kHz i-f amplifier circuit board). Set the tone generator for 0.4 volt rms output.

(d) Inject a carrier signal from the FM signal generator into the receiver antenna receptacle and set "on-frequency". Set the attenuator at 1000 microvolts. (This step quiets the noise to give an audio only measurement.)

(e) Turn the volume or line level control clockwise until the test set meter reads at least 30 uA (5 watts of audio power). The OPEN-SPKR-LOAD switch on the test set must be in the LOAD position and the TEK-11 Audio Adapter must be used to prevent driving the meter off-scale. If the station has a local speaker use the OPEN position.

(f) If 5 watts of audio output cannot be obtained, signal level readings may be taken at each stage of the audio and squelch circuit to isolate the trouble to a defective stage. Readings may be taken with a Motorola Solid-State AC Voltmeter, or equivalent, with a 1000 Hz tone input at 0.4 volt as described in step (c). With this input, and maximum VOLUME setting, the minimum signal level at each stage in the circuit is shown in Table 3.

NOTE

Normally, signal levels will be significantly higher than the minimum levels shown. Final audio output will often be over 8 watts.

TABLE 3.
TYPICAL RECEIVER AUDIO READINGS

METERING POINT	TYPICAL READING*
Base of preamplifier Q341	100 mV
Collector of preamplifier Q341	700 mV
Center arm of volume control (GRN lead connections of audio and squelch circuit board)	320 mV
Base of pre-driver Q342	100 mV
Collector of pre-driver Q342	700 mV
Base of differential amplifier Q343	100 mV
Base of differential amplifier Q344	56 mV
Collector of differential amplifiers Q343, Q344	3 V (each)
Base of output amplifiers Q345, Q346, (WHT-BLU and WHT-BRN connections)	0.55 V (each)
Collector of ourput amplifiers Q345, Q346	10 V (each)
Across speaker or secondary of T351	5.0 V

*Signal injection 0.4 v @ 1000 Hz at input to audio board.
Volume control setting @ maximum.
Receiver in full squelch and 1000 microvolts unmodulated signal.

TABLE 4.
TYPICAL CARRIER SQUELCH CIRCUIT READINGS

METERING POINT	TYPICAL READING
Input to audio board (GRN-RED lead from 455-kHz i-f board)	0.5 to 1 Vac
Base of limiter Q347	0.35 to 0.70 Vac
Collector of limiter Q347	3 Vac
Base of noise amplifier Q348	0.6 V ac
Collector of noise amplifier Q348	2.8 V ac
Base of noise detector Q349	0.7 V USQ -- 1.3 V FSQ
Collector of noise detector (Q349)	10.5 V USQ -- 4.8 V FSQ
Base of switch Q350	10.5 V USQ -- 4.9 V FSQ
Emitter of switch Q350	7.9 V USQ -- 5.6 V FSQ
USQ = Receiver Unsquelched. FSQ = Receiver Fully Squelched.	

(7) Squelch Circuit Checks

Disable the "Private-Line" function and turn the SQUELCH control fully clockwise to completely squelch the receiver. With no rf signal input, make the measurements as listed in Table 4 to determine whether or not the stages are operating properly and to isolate any malfunction in the circuit. If the receiver does not have sufficient noise to obtain the first reading, it may be necessary to connect the antenna to the receiver. Make the ac voltage measurements with a Motorola Solid-State AC Voltmeter, or equivalent, and dc voltage measurements with a Motorola Solid-State DC Multimeter or equivalent.

(8) Receiver Mute

If a two-receiver station is equipped with a receiver priority option, disconnect the muting input lead to the receiver and recheck operation. If operation is normal, troubleshoot the receiver priority circuits. In the local control unit (local control models) or power supply (remote control units).

i. "Private-Line" Tone-Coded Squelch Circuit Maintenance

(1) General

The "Vibrasponder" resonant reed serves as the frequency sensitive switching device in the receiver "Private-Line" squelch circuit. The reed is a precision built device. It consists of a tuned cantilever reed of special steel mounted on a rugged base with a coil and two permanent magnets. The entire assembly is spring-mounted and hermetically sealed in a metal housing to insure long life at peak performance under all types of conditions. Its resonant frequency is accurate within ±0.15%.

The tone-actuated squelch circuit begins with a low-pass filter and "PL" amplifier in the "PL" decoder which receives its input directly from the audio preamplifier. The output of the "PL" amplifier is coupled to an amplifier and clipper stage before it is applied to a driver stage which drives the coil of the resonant reed. When the detected tone signal applied to the reed is the same as its resonant frequency, the reed vibrates and causes a detector to respond and forward bias the output switch transistor in the decoder.

The output of the switch supplies cutoff bias to the squelch switch. When the squelch switch is cut off, the audio pre-driver stage turns on to convey audio to the differential amplifiers. In the absence of a proper tone signal, the squelch switch is on, cutting off the audio stages and quieting the speaker.

The sensitivity of the resonant reed is factory adjusted to give optimum performance for several years of continuous duty in the average system. The design of the "Vibrasponder" resonant reed eliminates the need for servicing throughout its useful life.

(2) Servicing

There are no special adjustments involved. Servicing is a matter of detecting and replacing defective components.

It is recommended that the serviceman keep a record of the test performed, voltage readings and other pertinent servicing data, each time the equipment is serviced. This will serve as a guide to normal operating conditions of individual units.

(3) Performance Checks

The receiver "PL" squelch sensitivity should be 0.25 microvolt or less.

There should be no "squelch tail" (noise burst from the speaker when the push-to-talk switch is first released). Also, there should be no "squelch tail" at the end of transmission from other stations in the communications system.

(4) Localizing the Defective Component

Gain measurements in the "Private-Line" decoder should be made with an input of 60 millivolts. Set up test equipment for gain measurements as follows:

Externally modulate the rf output of the signal generator with a "Private-Line" tone of the proper frequency to unsquelch the receiver at 0.5 kHz deviation. The "Private-Line" tone can be generated by using a Motorola Model SLN6221A Tone Generator and the "Vibrasender" resonant reed from the power supply of the radio, or by using a Motorola S1067A Transistorized Audio Oscillator and adjusting it to the "Private-Line" tone frequency. The tone frequency to be used is indicated on the "Vibrasponder" resonant reed in the receiver. Set the signal generator to the receiver carrier frequency and inject the output into the rf receptacle on the receiver chassis. Adjust the output level of the signal generator to 1000 microvolts. Make ac voltage measurements with a Motorola Solid-State AC Voltmeter or equivalent. Measure the ac signal voltage at the input to the decoder board and readjust the tone modulator for 60 millivolts on the ac voltmeter. Make voltage measurements at the points designated and compare with the typical readings in Table 5.

If "squelch tail" noise bursts are heard in listening receivers, check voltages in the "reverse burst" switch circuit of the transmitting station.

j. Receiver Balance

Check receiver balance. Shift the signal generator frequency above and below the carrier frequency while monitoring the portable test set meter on position 4. The meter should swing equal distances above and below the zero center reading for equal shifts in frequency.

k. Receiver Audio

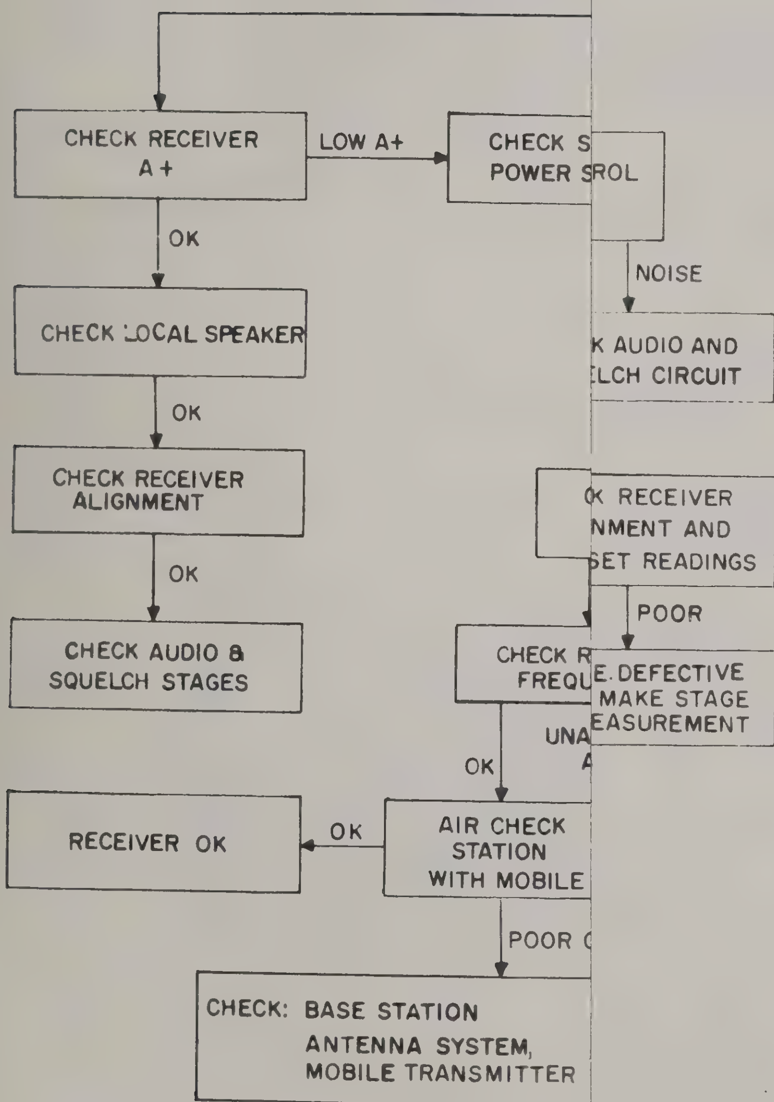
Check the receiver audio section. With the VOLUME control at maximum and the carrier signal modulated with 1000-Hz tone at 2/3 rated system deviation (3.3 kHz), there should be at least 5 watts audio output (4 volts ac across the speaker).

Individual stages can be checked by injecting an audio signal and measuring signal voltages at each stage. Set the receiver VOLUME control to maximum and the SQUELCH control fully counterclockwise (unsquelched). On "Private-Line" tone-coded squelch models, also "PL" disable. Inject a 1000-Hz tone at 0.4 volt rms into the audio board (input from discriminator). The Motorola SLN6221A Transistorized Tone Generator is ideal for generating this tone.

TABLE 5.
"PL" DECODER READINGS

METERING POINT	TYPICAL READING*
Input to decoder board (GRAY-GRN lead from audio board)	60 mV ac
Base of "PL" Amplifier (Q751)	10 mV ac
Collector of "PL" Amplifier (Q751)	220 mV ac
Base of amplifier/clipper (Q752)	210 mV ac
Collector of amplifier/clipper (Q752)	2.8 V ac
Base of "Vibrasponder" driver (Q753)	540 mV ac
Emitter of "Vibrasponder" driver (Q753) (primary of resonant reed)	500 mV ac
Base of amplifier (Q754) (secondary of resonant reed)	100 mV ac
Collector of amplifier (Q754)	2.0 V ac
Base of detector (Q755)	1.8 V ac
Collector of detector (Q755)	2.7 V dc
Base of output switch (Q756)	11.4 V dc
Collector of output switch (Q756)	11.9 V dc
Base of noise switch (Q757)	0.7 V dc

*Readings taken with 1000 mv input rf signal and 0.5 kHz tone deviation.


CHECK RECEIVER A+
LOW A+
OK
CHECK LOCAL SPEAKER
OK
CHECK RECEIVER ALIGNMENT
OK
CHECK AUDIO & SQUELCH STAGES
NOISE
POOR
OK
RECEIVER OK
OK
AIR CHECK STATION WITH MOBILE
CHECK: BASE STATION
ANTENNA SYSTEM,
MOBILE TRANSMITTER

RECEIVER

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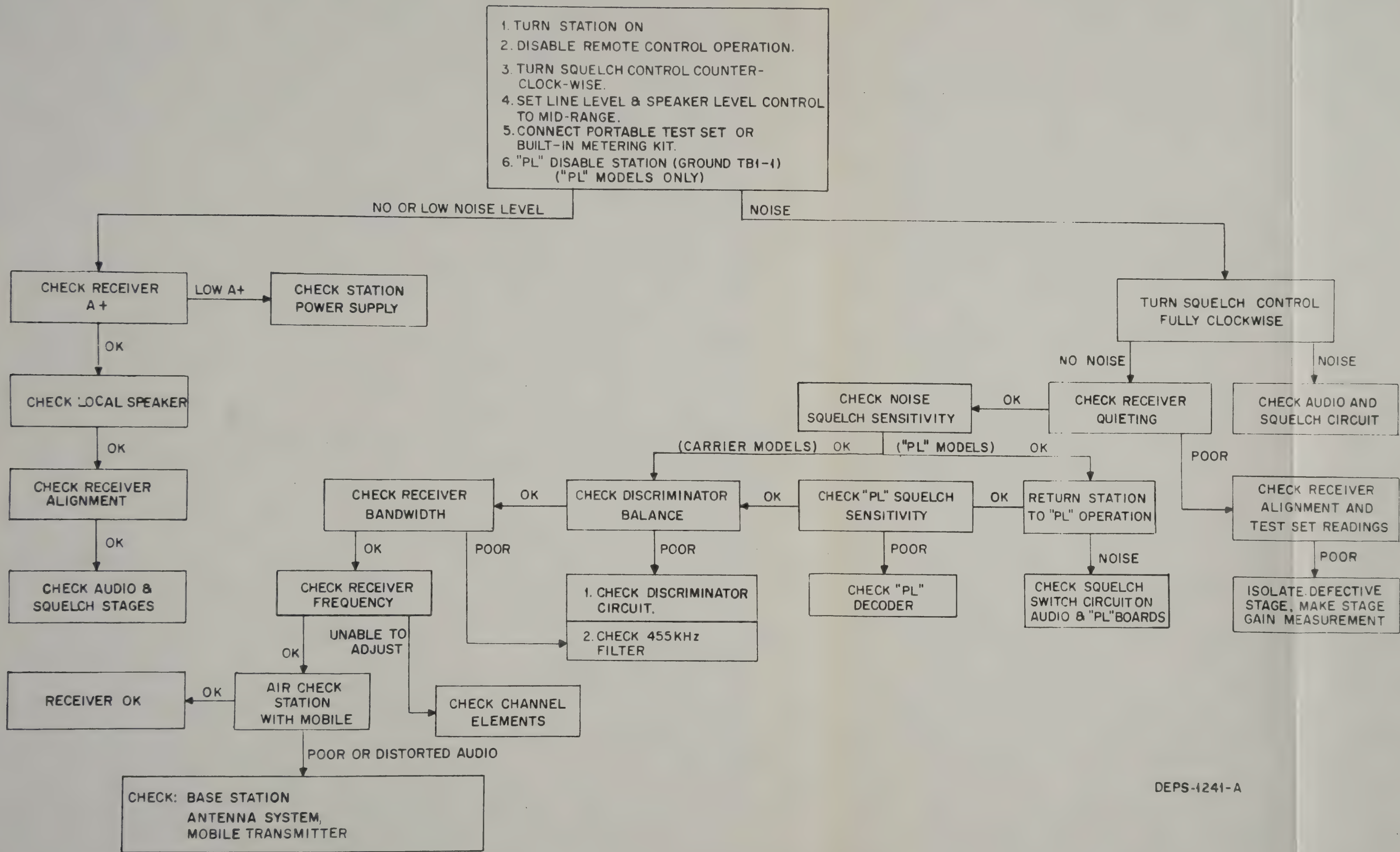
Base of amplifier (Q754) (secondary of resonant reed)	100 mV ac
Collector of amplifier (Q754)	2.0 V ac
Base of detector (Q755)	1.8 V ac
Collector of detector (Q755)	2.7 V dc
Base of output switch (Q756)	11.4 V dc
Collector of output switch (Q756)	11.9 V dc
Base of noise switch (Q757)	0.7 V dc
*Readings taken with 1000 mv input rf signal and 0.5 kHz tone deviation.	

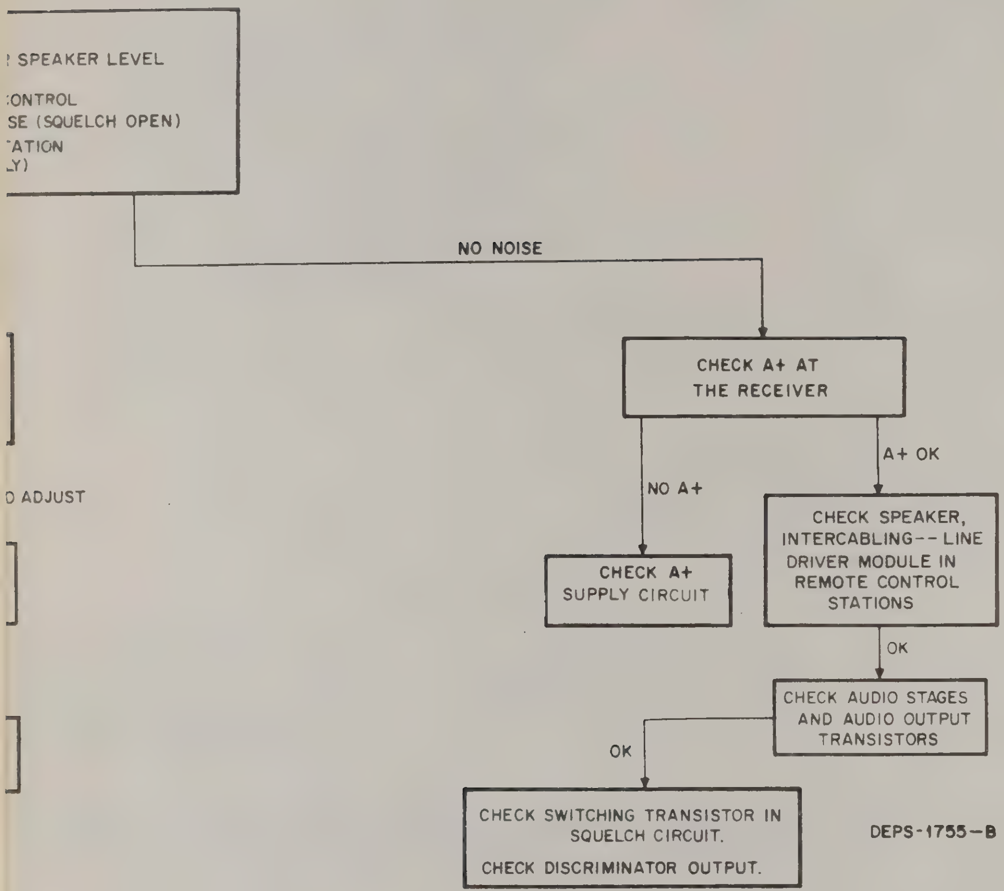
RECEIVER

RECEIVER TROUBLESHOOTING CHART



DEPS-1241-A

OUBLESHOOTING CHART



DEPS-1755-B

1. Removal of Circuit Boards

Complete removal of the printed circuit boards for access to components is not always necessary. For instance, the audio board in the receiver may be partially disconnected and folded out.

The steps called out on the circuit board removal illustrations should be followed to prepare various parts of the receiver for servicing. Observe standard servicing practices, such as tagging of leads and identification of connecting points.

When removing circuit boards from the front of the receiver, remove the oscillator cover shield before starting to unsolder any leads.

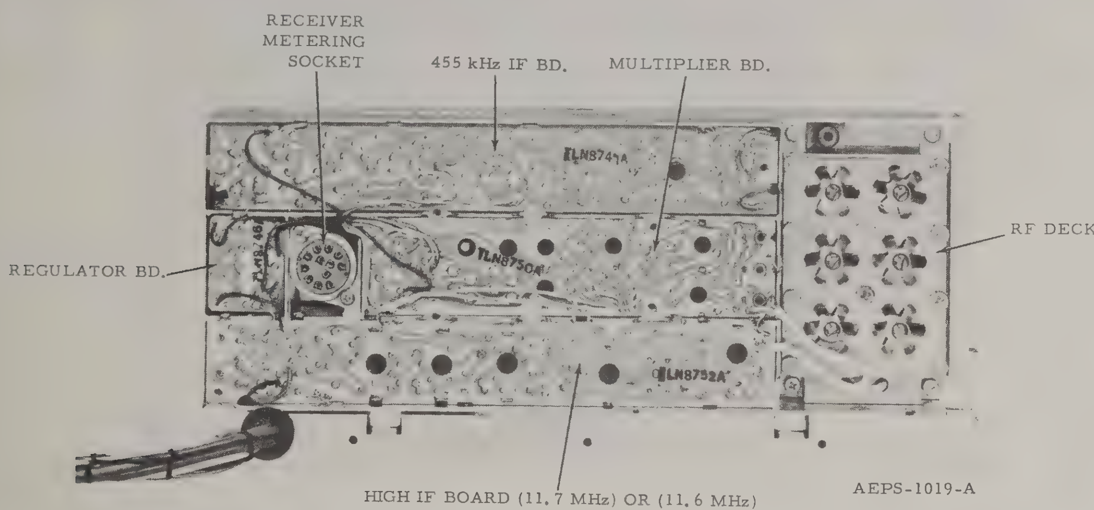


Figure 4.
Parts Location Detail, Front View

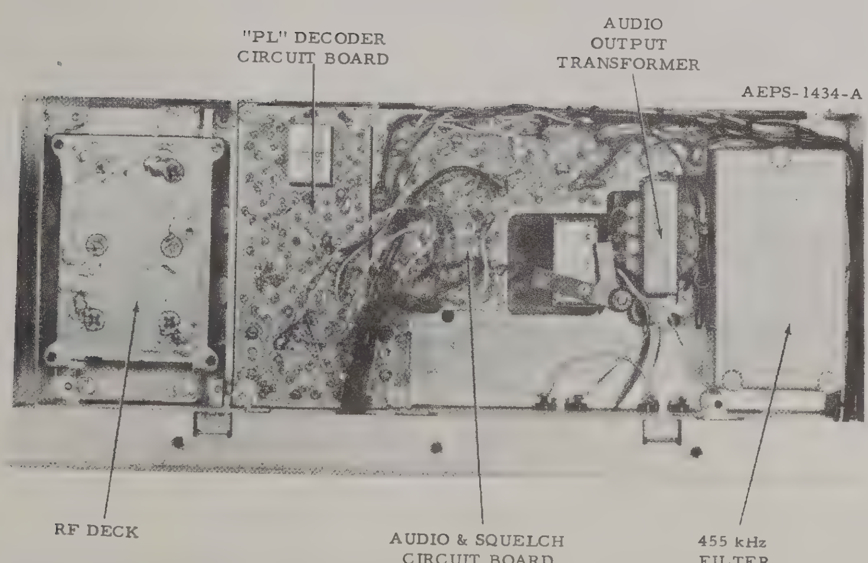
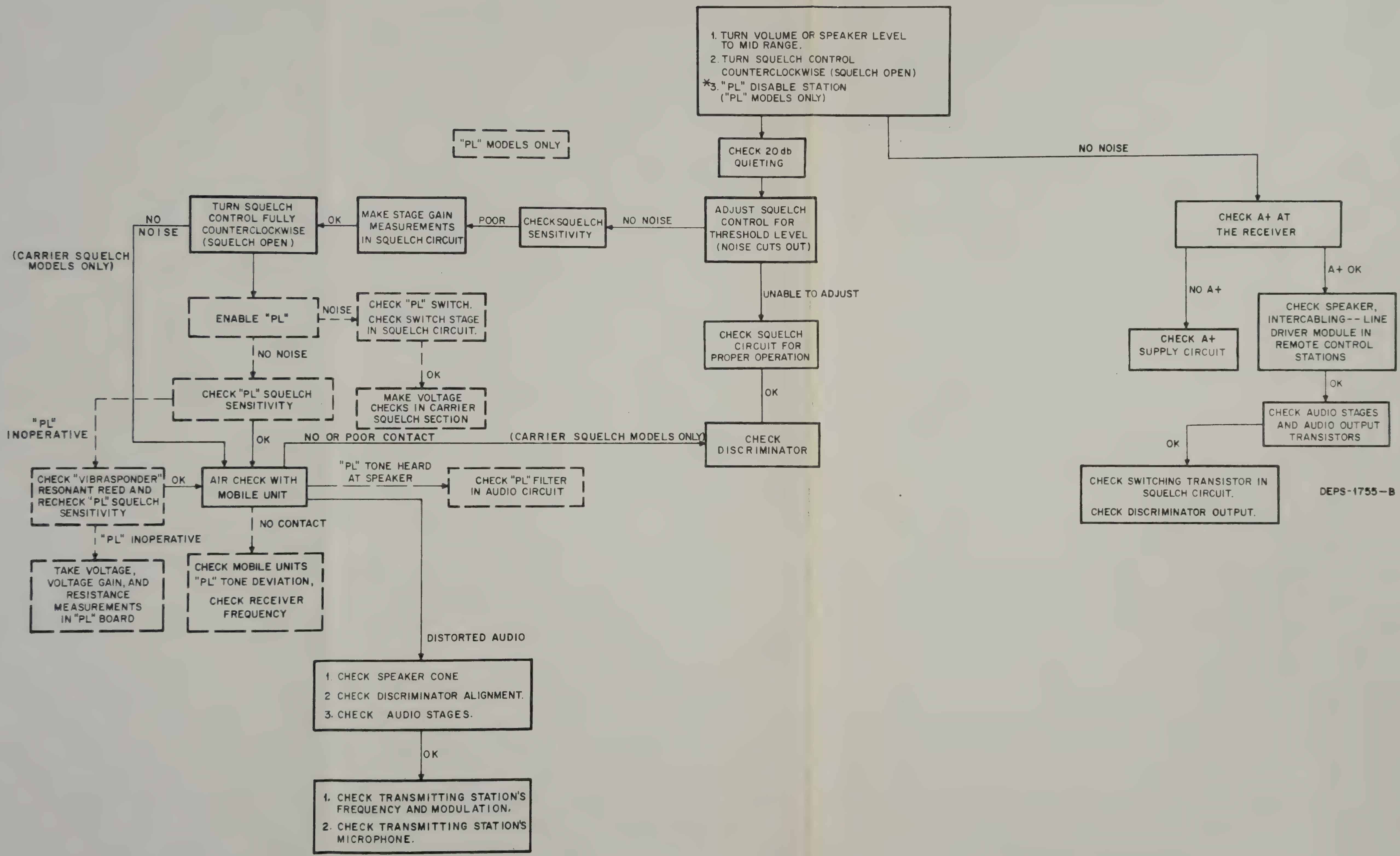


Figure 5.
Parts Location Detail, Rear View

RECEIVER

AUDIO AND SQUELCH TROUBLESHOOTING CHART



RECEIVER

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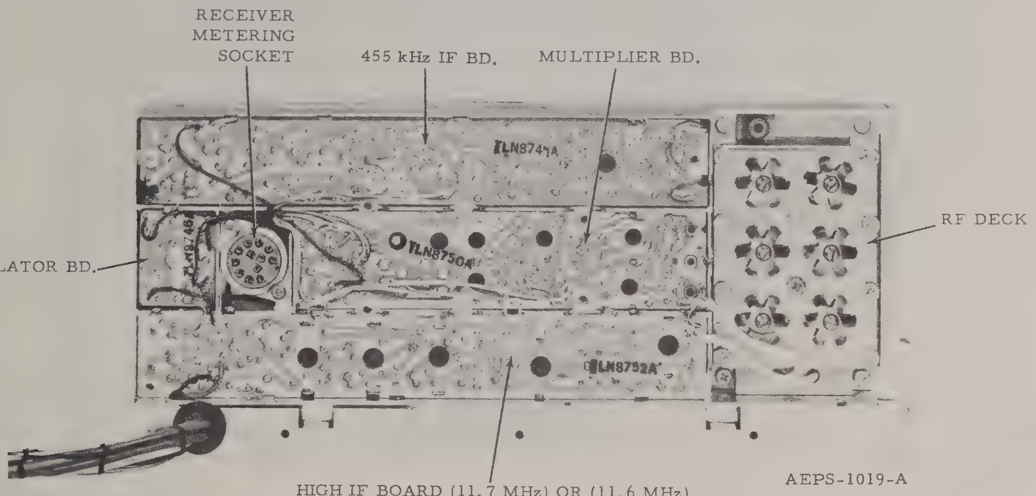


Figure 4.
Parts Location Detail, Front View

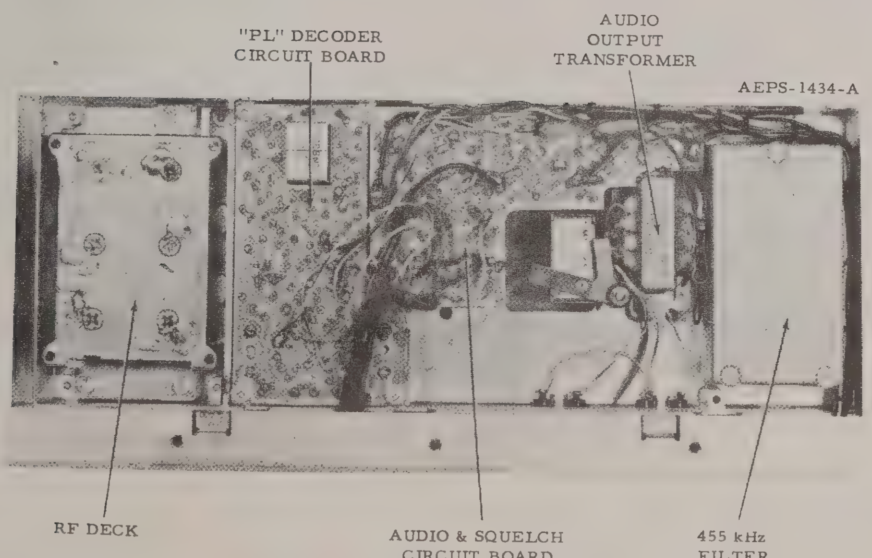


Figure 5.
Parts Location Detail, Rear View

RECEIVER

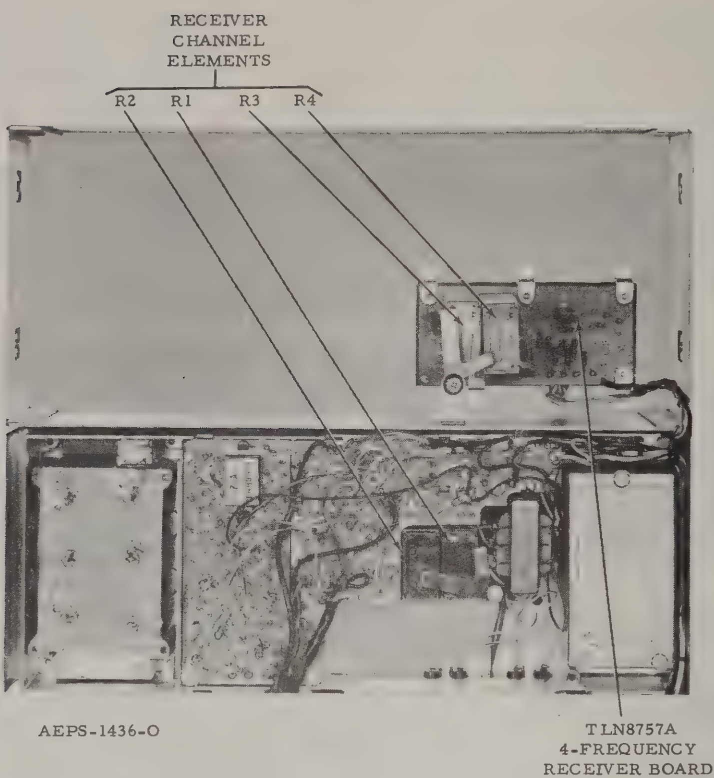


Figure 6.
Multi-Frequency Receiver Parts Location Detail

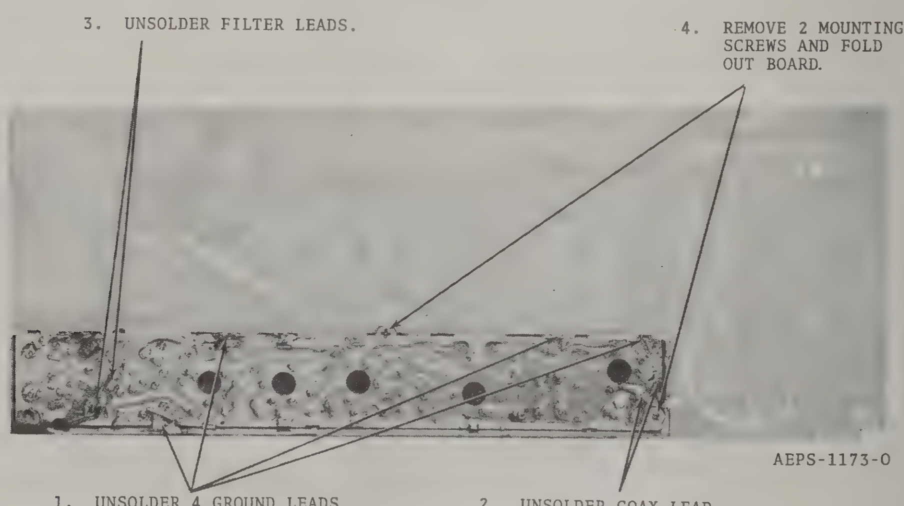


Figure 7.
Access to High IF Board

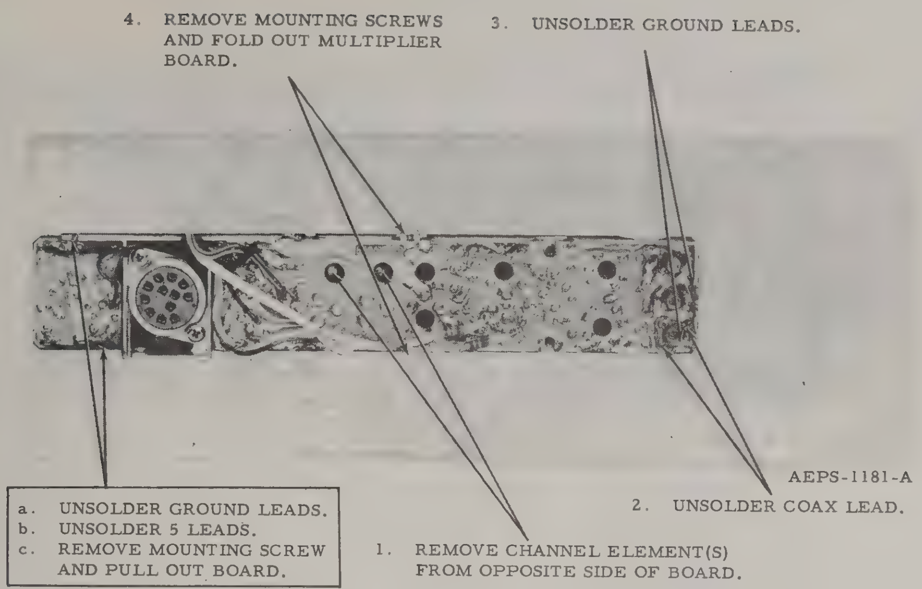


Figure 8.
Access to Multiplier and Regulator Boards

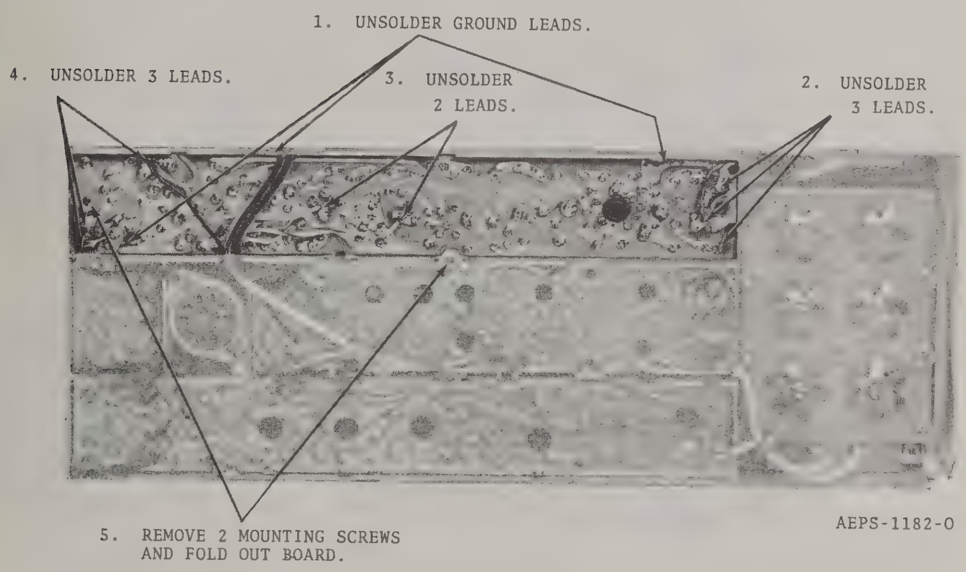


Figure 9.
Access to 455 kHz IF Amplifier Circuit Board

RECEIVER

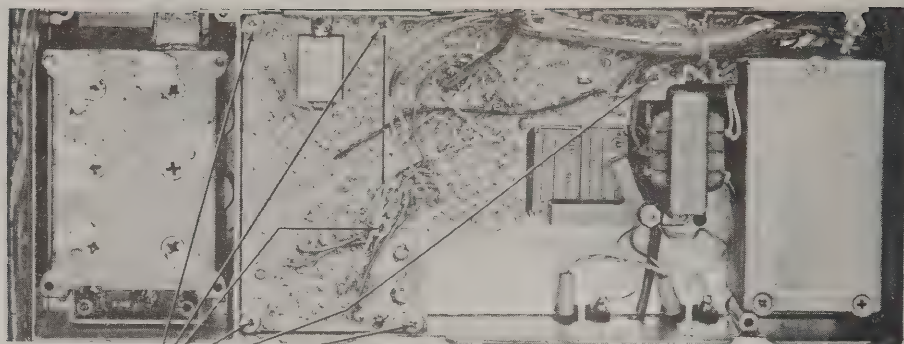


Figure 10.
Access to Audio & Squelch and "Private-Line" Decoder Circuit Boards

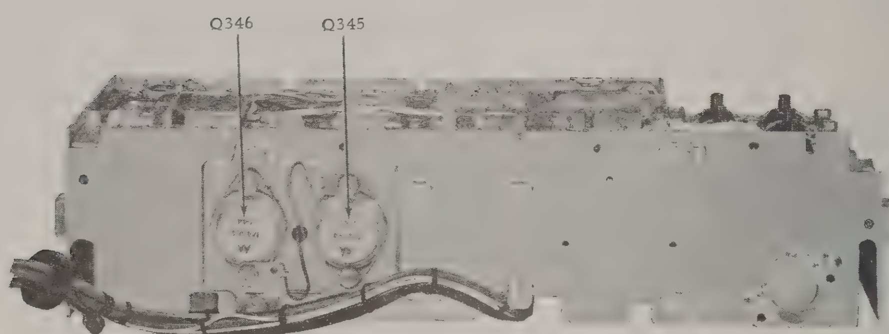
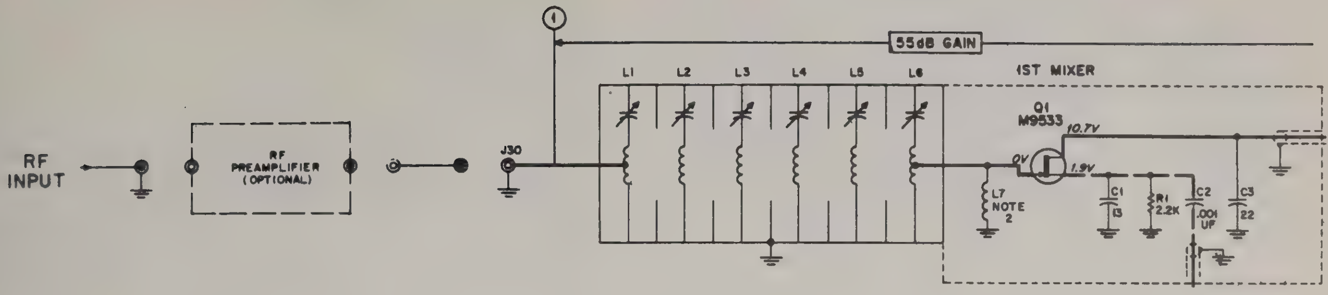
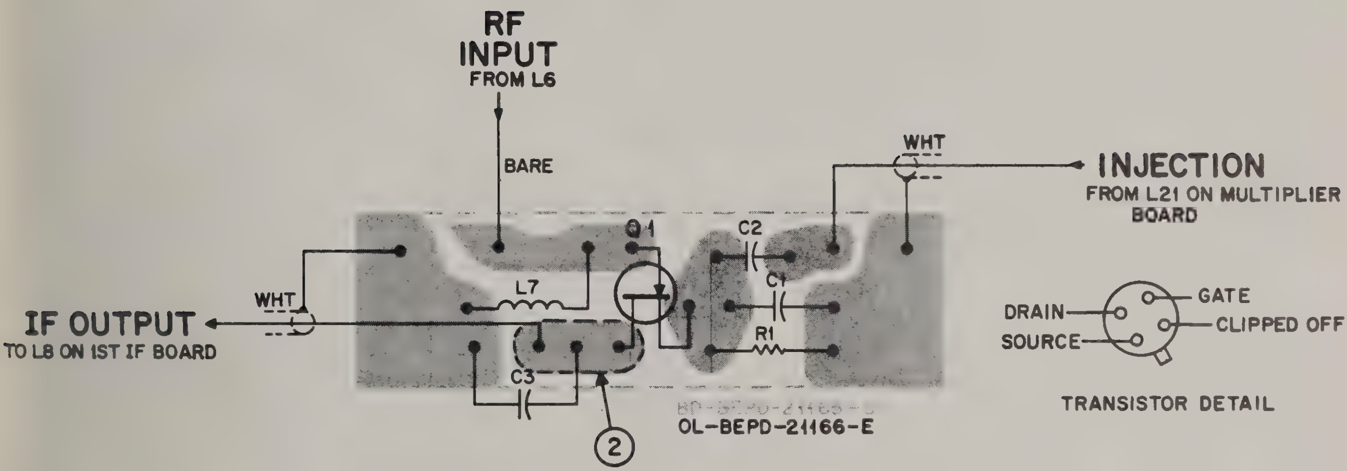


Figure 11.
Audio Power Transistor Locations





REFER TO RECEIVER SCHEMATIC
DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Model TLE6360A Series RF Deck
Circuit Board Detail
Motorola No. PEPS-1162-G
8/23/72- UP

REVISIONS

PEPS-1162-G

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE6362A	Q1	WAS 48R869565 TYPE M9565	1ST MIXER
TLE6362A-1 TLE6363A		430-450 MHz MODEL ADDED	PARTS LIST
TLE6364A TLE6365A		470-494 MHz & 494-512 MHz MODELS ADDED	

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		*41-84410B03 NUT, tuning screw locking: "star" type (6 req'd) *Screws and nuts used with L1 thru L6.

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

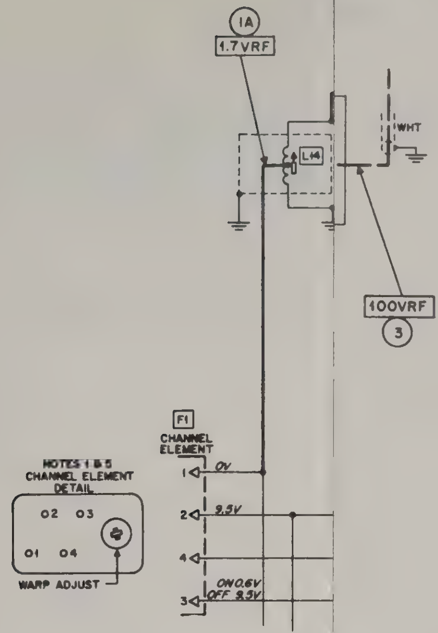
LEGEND:
LL = 406-430 MHz
L = 430-450 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz

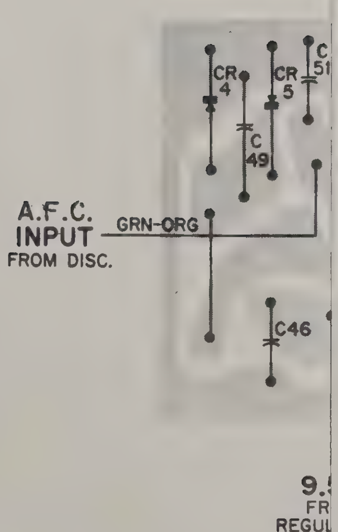
RF DECK

TLE6361A (406-430 MHz)
TLE6363A (430-450 MHz)
TLE6362A (450-470 MHz)
TLE6364A (470-494 MHz)
TLE6365A (494-512 MHz)

PL-1320-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	21-867302	13 pF ±5%; 500 V
C2	21-83880G01	.001 uF ±10%; 100 V
C3	21-124554	22 pF ±5%; 500 V; NP0
		CONNECTOR, receptacle:
J1	9-84135B01	female; coaxial; miniature type
		COIL, RF:
L1LL	1-80714B11	4-3/8 turns; tapped at "ground" end
L1L	1-80718B55	4-1/8 turns; tapped at "ground" end
L1M	1-80780A73	4 turns; tapped at "ground" end
L1H	1-80727B50	3-7/8 turns; tapped at "ground" end
L1HH	1-80727B52	3-11/16 turns; tapped at "ground" end
L2LL	24-83853G19	4-3/8 turns
L2L	24-83853G25	4-1/8 turns
L2M	24-83853G03	4 turns
L2H	24-83853G32	3-7/8 turns
L2HH	24-83853G35	3-11/16 turns
L3LL	24-83853G19	4-3/8 turns
L3L	24-83853G25	4-1/8 turns
L3M	24-83853G03	4 turns
L3H	24-83853G32	3-7/8 turns
L3HH	24-83853G35	3-11/16 turns
L4LL	24-83853G19	4-3/8 turns
L4L	24-83853G25	4-1/8 turns
L4M	24-83853G03	4 turns
L4H	24-83853G32	3-7/8 turns
L4HH	24-83853G35	3-11/16 turns
L5LL	24-83853G19	4-3/8 turns
L5L	24-83853G25	4-1/8 turns
L5M	24-83853G03	4 turns
L5H	24-83853G32	3-7/8 turns
L5HH	24-83853G35	3-11/16 turns
L6LL	1-80714B10	4-1/2 turns; tapped at 1-5/8 turns from "ground" end
L6L	1-80718B54	4-1/8 turns; tapped at 1-5/8 turns from "ground" end
L6M	1-80780A72	4-1/4 turns; tapped at 1-5/8 turns from "ground" end
L6H	1-80727B49	3-7/8 turns; tapped
L6HH	1-80727B51	4 turns; tapped
L7LL	24-83884G06	4-3/4 turns; coded WHT
L7L	24-83884G06	4-3/4 turns; coded WHT
L7M	24-83884G01	3-3/4 turns; coded RED
L7H	24-83884G07	2-1/2 turns; coded GRN
L7HH	24-83884G07	2-1/2 turns; coded GRN
		TRANSISTOR: (SEE NOTE)
Q1	48-869533	field-effect: type M9533
		RESISTOR, fixed:
R1	6-185B83	2.2k ±10%; 1/8 W
	NON-REFERENCED ITEMS	
	15-83855G01	PLATE, mixer cover
	1-80709B53	TUNING ASSEMBLY: includes: 64-83852G01 PLATE, cover 3-84127B01 SCREW, tuning 10-32 x 7/8" headless; slotted driver (6 req'd)





RECEIVER

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Multiplier Circuit Board Detail for
1-Frequency Receivers
Motorola No. PEPS-1783-F
8/23/72-UP

REVISIONS

PEPS-1162-G

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NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

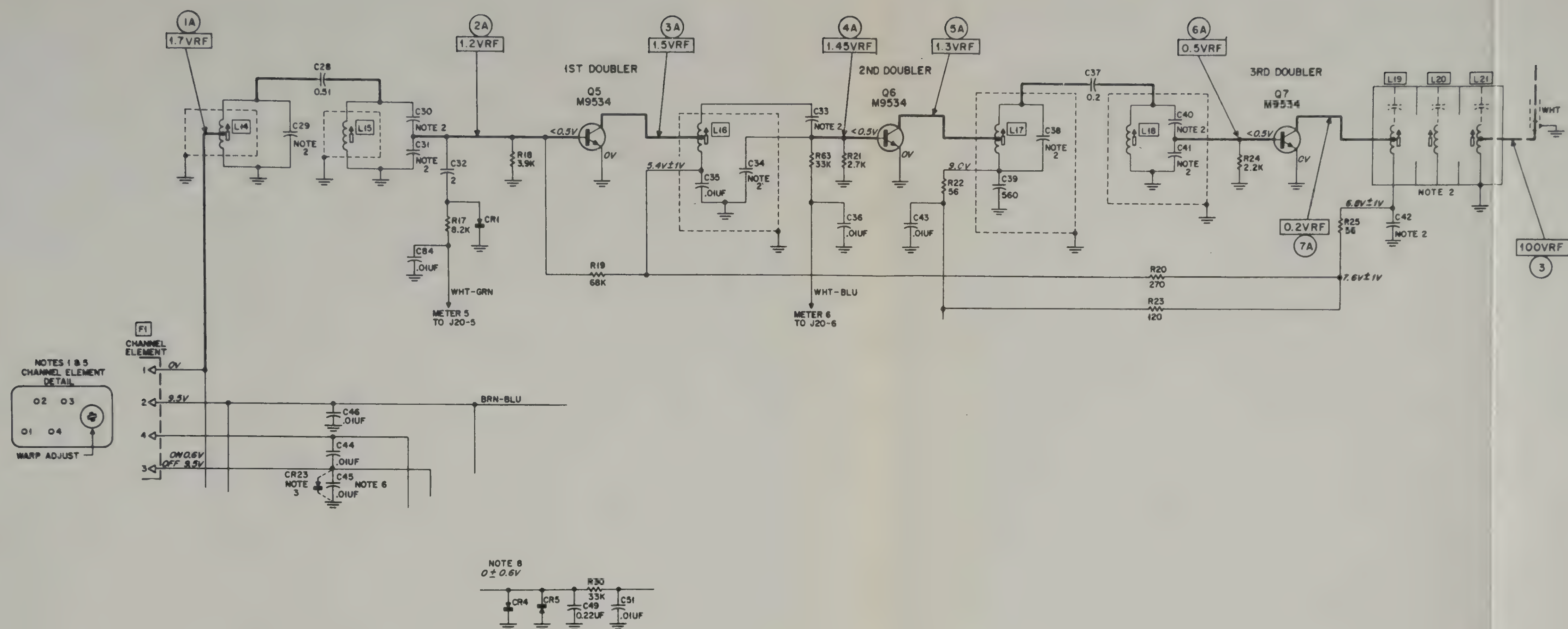
LEGEND:
LL = 406-430 MHz
L = 430-450 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz

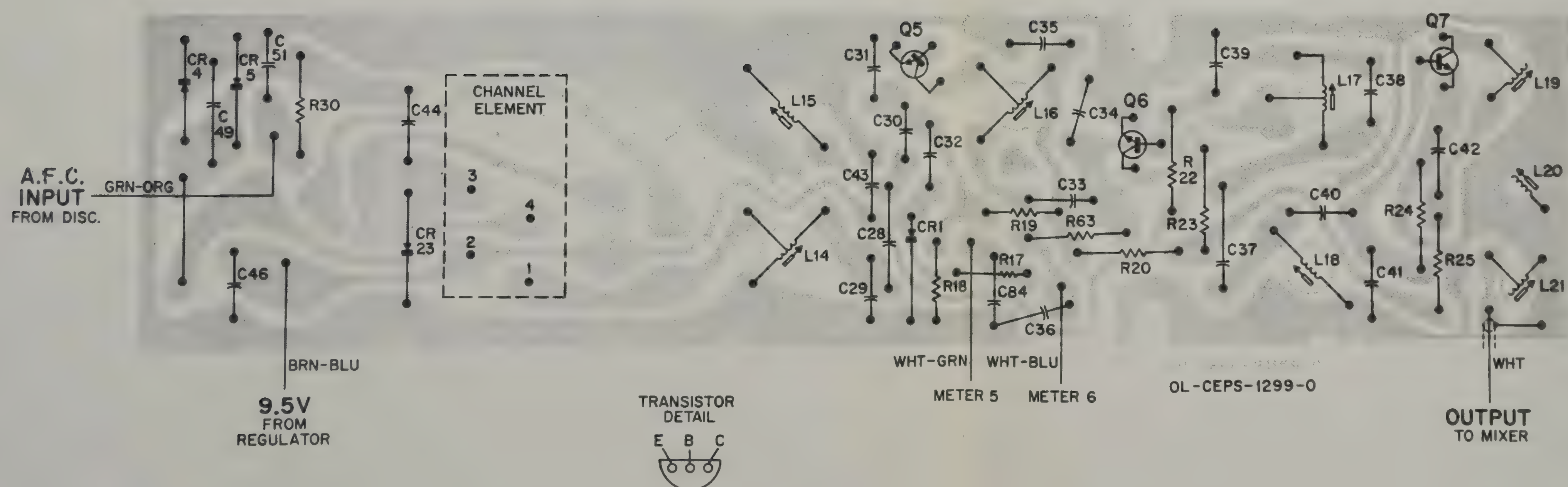
RF DECK

TLE6361A (406-430 MHz)
TLE6363A (430-450 MHz)
TLE6362A (450-470 MHz)
TLE6364A (470-494 MHz)
TLE6365A (494-512 MHz)

PL-1320-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	21-867302	13 pF ±5%; 500 V
C2	21-83880G01	.001 uF ±10%; 100 V
C3	21-124554	22 pF ±5%; 500 V; NP0
		CONNECTOR, receptacle:
J1	9-84135B01	female; coaxial; miniature type
		COIL, RF:
L1LL	1-80714B11	4-3/8 turns; tapped at "ground" end
L1L	1-80718B55	4-1/8 turns; tapped at "ground" end
L1M	1-80780A73	4 turns; tapped at "ground" end
L1H	1-80727B50	3-7/8 turns; tapped at "ground" end
L1HH	1-80727B52	3-11/16 turns; tapped at "ground" end
L2LL	24-83853G19	4-3/8 turns
L2L	24-83853G25	4-1/8 turns
L2M	24-83853G03	4 turns
L2H	24-83853G32	3-7/8 turns
L2HH	24-83853G35	3-11/16 turns
L3LL	24-83853G19	4-3/8 turns
L3L	24-83853G25	4-1/8 turns
L3M	24-83853G03	4 turns
L3H	24-83853G32	3-7/8 turns
L3HH	24-83853G35	3-11/16 turns
L4LL	24-83853G19	4-3/8 turns
L4L	24-83853G25	4-1/8 turns
L4M	24-83853G03	4 turns
L4H	24-83853G32	3-7/8 turns
L4HH	24-83853G35	3-11/16 turns
L5LL	24-83853G19	4-3/8 turns
L5L	24-83853G25	4-1/8 turns
L5M	24-83853G03	4 turns
L5H	24-83853G32	3-7/8 turns
L5HH	24-83853G35	3-11/16 turns
L6LL	1-80714B10	4-1/2 turns; tapped at 1-5/8 turns from "ground" end
L6L	1-80718B54	4-1/8 turns; tapped at 1-5/8 turns from "ground" end
L6M	1-80780A72	4-1/4 turns; tapped at 1-5/8 turns from "ground" end
L6H	1-80727B49	3-7/8 turns; tapped
L6HH	1-80727B51	4 turns; tapped
L7LL	24-83884G06	4-3/4 turns; coded WHT
L7L	24-83884G06	4-3/4 turns; coded WHT
L7M	24-83884G01	3-3/4 turns; coded RED
L7H	24-83884G07	2-1/2 turns; coded GRN
L7HH	24-83884G07	2-1/2 turns; coded GRN
		TRANSISTOR: (SEE NOTE)
Q1	48-869533	field-effect; type M9533
		RESISTOR, fixed:
R1	[illegible]	2.2k ±10%, 1/8 W
	NON-REFERENCED ITEMS	
	15-83855G01	PLATE, mixer cover
	1-80709B53	TUNING ASSEMBLY: includes; 64-83852G01 PLATE, cover 3-84127B01 SCREW, tuning 10-32 x 7/8" headless; slotted driver (6 req'd)





REFER TO RECEIVER SCHEMATIC
DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Multiplier Circuit Board Detail for
1-Frequency Receivers
Motorola No. PEPS-1783-F
8/23/72-UP

MOTOROLA PART NO.	DESCRIPTION
21-848525	16; NP0
21-840365	24; NP0
21-840365	24; NP0
21-82428B62	.01 uF +80-20%; 200 V
21-82428B59	.01 uF +80-20%; 200 V
21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
21-82428B59	.01 uF +80-20%; 200 V
21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
8-82905G11	0.22 uF ±10%; 50 V
21-82428B59	.01 uF +80-20%; 200 V
21-82428B62	.01 uF +80-20%; 200 V
	SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
48-82921G02	germanium
48-82392B13	silicon
48-82392B13	silicon
48-82392B03	silicon (single-freq only)
	COIL, RF:
24-83857G01	BRN; 8-1/2 turns, tapped at 2-1/8 turns; incl tuning core
24-83857G02	RED; 8-1/2 turns; incl tuning core
24-83857G03	ORG; 6-1/2 turns, tapped at 7/8 turn; incl tuning core
24-83857G04	YEL; 3-1/2 turns, tapped at 7/8 turn; incl tuning core
24-83857G05	GRN; 3-1/2 turns; incl tuning core
1-80714B13	13-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
1-80718B56	12 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
1-80780A83	12-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
1-80727B55	11-3/4 turns; tapped at 1-3/4 turns
1-80727B57	10-5/8 turns; tapped at 1-3/4 turns
24-83858G05	14-1/4 turns
24-83858G03	13 turns
24-83858G02	13-5/8 turns
24-83858G14	12 turns
24-83858G17	11-5/8 turns
1-80714B14	15-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
1-80718B57	13-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
1-80780A84	13-7/8 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
1-80727B54	12-3/4 turns; tapped at 3-1/4 turns
1-80727B56	12 turns; tapped at 3-1/4 turns
	TRANSISTOR: (SEE NOTE)
48-869534	N-P-N; type M9534
48-869534	N-P-N; type M9534
48-869534	N-P-N; type M9534
	RESISTOR, fixed: ±10%; 1/4 W unl otherwise stated
6-185B90	8.2k; 1/8 W
6-185B86	3.9k; 1/8 W
6-185C02	68k; 1/8 W
6-129752	270
6-128688	2.7k
6-129860	56
6-129617	120
6-128689	2.2k
6-129860	56
6-127807	33k
6-127807	33k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
NON-REFERENCED ITEMS		
	26-82221H01	SHIELD, coil: used with L14, L15
	26-82076C01	SHIELD, coil: used with L16, L17, L18
	1-80780A82	SHIELD, coil: used with L19, L20, L21

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

Electro-Voice ENGINEERING DATA

428 STAND AND 448 BOOM MOUNT

K9KGA

Model 428 Touch To Talk Stand

FEATURES

- Strong Die-Cast Zinc
- Satin Chrome Plated
- Fits Standard Microphone Mounts

SPECIFICATIONS

Material:	Diecast zinc and plastic
Finish:	Satin Chrome and gray
Dimensions:	Height: 7 inches
	Base Diameter: 5-1/8 inches.
Weight:	1-3/4 lbs.

The Electro-Voice Model 428 microphone stand fits any standard microphone mount having 5/8" -27 threads. The switch, a double-pole, double-throw blade type, is actuated by a lever. A locking button permits steady operation over long time intervals without steady thumb pressure. Switch terminals are made accessible for soldering by removing the protective aluminum shield. The stand is finished in satin chrome; lever, of durable high-impact plastic, is gray.

WIRING

The switching of the Model 428 provides for control of the microphone circuit itself as well as for external relay-operated equipment. A typical arrangement is shown in Figure 1.

The microphone is normally shorted when wired as shown in Figure 1. When the switch is depressed, contacts are opened to permit operation of the microphone. When multiple microphones are used with the same amplifier input, the shorting connections on one microphone will short the others, as well. The switch should therefore be wired so that the contacts complete the microphone circuit instead of breaking the ground connection.

The other contacts actuate external relay equipment when the switch is depressed. Both make and break contacts are available. If the switch is used to break into an inductive circuit carrying substantial power, care should be taken to bypass the circuit at its source to prevent arcing.

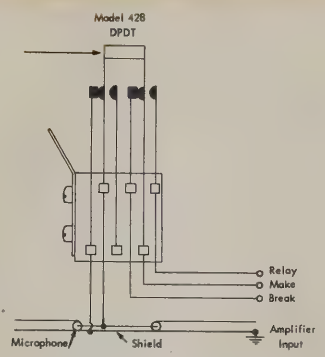


Figure 1- Model 428-Wiring Diagram

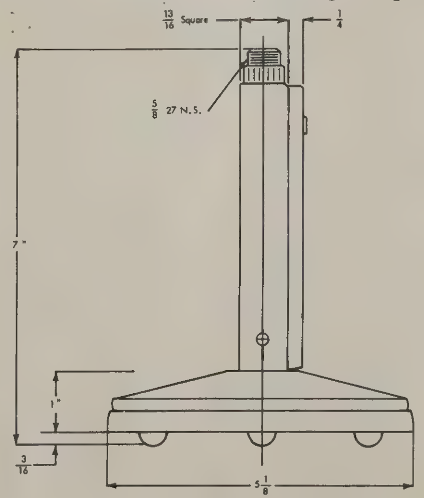


Figure 2- Model 428-Dimensions

428 STAND AND 448 BOOM MOUNT

REVISIONS

PEPS-1783-F

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8748A TLN8749A	C39	WAS 21C82187B06, 560 pF	PARTS LIST
TLN8748A-1 TLN8749A-1 TLN4563A TLN4564A		430-450 MHz MODELS ADDED	
TLN4770A TLN4771A TLN4772A TLN4773A		470-494 MHz & 494-512 MHz MODELS ADDED	

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

LEGEND:
LL = 406-430 MHz
L = 430-450 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz

MULTIPLIER BOARD

TLN8748A (Single-Frequency: 406-430 MHz)
TLN4564A (Single-Frequency: 430-450 MHz)
TLN8750A (Single-Frequency: 450-470 MHz)
TLN4770 (Single-Frequency: 470-494 MHz)
TLN4771 (Single-Frequency: 494-512 MHz)
TLN8749A (Multi-Frequency: 406-430 MHz)
TLN4563A (Multi-Frequency: 430-450 MHz)
TLN8751A (Multi-Frequency: 450-470 MHz)
TLN4772 (Multi-Frequency: 470-494 MHz)
TLN4773 (Multi-Frequency: 494-512 MHz)

PL-1323-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unl otherwise stated
C28	21-82450B29	0.51; coded GRN-BRN-GRAY-GOLD
C29LL	21-83406D82	36; NP0
C29L	21-83406D71	33; NP0
C29M	21-114166	30 ±10%; NP0
C29H	21-82133G06	27; NP0 (single-freq)
C29HH	or21-840365	24; NP0 (multi-freq)
C30LL	21-840365	24; NP0 (single-freq)
C29HH	or21-82204B34	22; NP0 (single-freq)
C30LL	21-84493B27	51; 200 V; NP0
C30L	21-83406D87	43; NP0
C30M	21-82610C45	40; 100 V; NP0
C30H	21-82610C86	36; 200 V; NP0
C30HH	21-83406D19	33; NP0
C31LL	21-82610C09	120; 200 V; N220
C31L	21-82610C09	120; 200 V; N220
C31M	21-82610C44	100; 100 V; N220
C31H	21-82610C63	91; 200 V; N220
C31HH	21-84493B32	82; 200 V; N220
C32	21-857336	2 ±0.25 pF; NP0
C33LL	21-83406D83	12; N150
C33L	21-838686	10 ±5%; N150
C33M	21-859642	9 ±0.5 pF; N150
C33H	21-847873	8.2; N150
C33HH	21-847873	8.2; N150
C34LL	21-84493B29	47; 200 V; N470
C34L	21-83406D88	40; N470
C34M	21-859697	30; N470
C34H	21-124946	27; N470
C34HH	21-124946	27; N470
C35	21-832501	.01 uF +60-40%; 250 V
C36	21-82428B59	.01 uF +80-20%; 200 V
C37	21-82450B35	0.2 ±10%; coded RED-BLK-GRAY-SILVER
C38LL	21-83406D53	3.3 ±0.25 pF; NP0
C38L	21-83406D66	2.7 ±0.25 pF; NP0
C38M	21-857336	2 ±0.25 pF; NP0
C39LL	21-84493B14	68; 200 V; NP0
C39L	21-82187B06	560
C39M	21-82187B06	560
C39H	21-865922	390 ±10%
C39HH	21-865922	390 ±10%
C40LL	21-82204B03	6 ±0.5 pF; NP0
C40L	21-82204B03	6 ±0.5 pF; NP0
C40M	21-840850	4 ±0.5 pF; NP0
C40H	21-840850	4 ±0.5 pF; NP0
C40HH	21-83406D53	3.3 ±0.25 pF; NP0
C41LL	21-83406D73	7.5 ±0.5 pF; NP0
C41L	21-83406D65	5 ±0.25 pF; NP0
C41M	21-83406D65	5 ±0.25 pF; NP0
C41H	21-840847	5; NP0
C41HH	21-82355B39	4.7 ±0.25 pF; NP0
C42LL	21-84493B21	30; 200 V NP0
C42L	21-83406D67	22; NP0
C42M	21-848525	16; NP0
C42H	21-840365	24; NP0
C42HH	21-840365	24; NP0
C43	21-82428B62	.01 uF +80-20%; 200 V
C44	21-82428B59	.01 uF +80-20%; 200 V
C45	21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
C46	21-82428B59	.01 uF +80-20%; 200 V
C47	21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
C48	21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
C49	8-82905G11	0.22 uF ±10%; 50 V
C51	21-82428B59	.01 uF +80-20%; 200 V
C84	21-82428B62	.01 uF +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48-82921G02	germanium
CR4	48-82392B13	silicon
CR5	48-82392B13	silicon
CR23	48-82392B03	silicon (single-freq only)
		COIL, RF:
L14	24-83857G01	BRN; 8-1/2 turns, tapped at 2-1/8 turns; incl tuning core
L15	24-83857G02	RED; 8-1/2 turns; incl tuning core
L16	24-83857G03	ORG; 6-1/2 turns, tapped at 7/8 turn; incl tuning core
L17	24-83857G04	YEL; 3-1/2 turns, tapped at 7/8 turn; incl tuning core
L18	24-83857G05	GRN; 3-1/2 turns; incl tuning core
L19LL	1-80714B13	13-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
L19L	1-80718B56	12 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
L19M	1-80780A83	12-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
L19H	1-80727B55	11-3/4 turns; tapped at 1-3/4 turns
L19HH	1-80727B57	10-5/8 turns; tapped at 1-3/4 turns
L20LL	24-83858G05	14-1/4 turns
L20L	24-83858G03	13 turns
L20M	24-83858G02	13-5/8 turns
L20H	24-83858G14	12 turns
L20HH	24-83858G17	11-5/8 turns
L21LL	1-80714B14	15-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
L21L	1-80718B57	13-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
L21M	1-80780A84	13-7/8 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
L21H	1-80727B54	12-3/4 turns; tapped at 3-1/4 turns
L21HH	1-80727B56	12 turns; tapped at 3-1/4 turns
		TRANSISTOR: (SEE NOTE,
Q5	48-869534	N-P-N; type M9534
Q6	48-869534	N-P-N; type M9534
Q7	48-869534	N-P-N; type M9534
		RESISTOR, fixed: ±10%; 1/4 W unl otherwise stated
R17	6-185B90	8.2k; 1/8 W
R18	6-185B86	3.9k; 1/8 W
R19	6-185C02	68k; 1/8 W
R20	6-129752	270
R21	6-128688	2.7k
R22	6-129860	56
R23	6-129617	120
R24	6-128689	2.2k
R25	6-129860	56
R30	6-127807	33k
R63	6-127807	33k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	26-82221H01	SHIELD, coil: used with L14, L15
	26-82076C01	SHIELD, coil: used with L16, L17, L18
	1-80780A82	SHIELD, coil: used with L19, L20, L21

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

428 STAND AND 448 BOOM MOUNT

Model 428 Touch To Talk Stand

The Electro-Voice Model 428 microphone stand fits any standard microphone mount having 5/8" -27 threads. The switch, a double-pole, double-throw blade type, is actuated by a lever. A locking button permits steady operation over long time intervals without steady thumb pressure. Switch terminals are made accessible for soldering by removing the protective aluminum shield. The stand is finished in satin chrome; lever, of durable high-impact plastic, is gray.

FEATURES

- Strong Die-Cast Zinc
- Satin Chrome Plated
- Fits Standard Microphone Mounts

SPECIFICATIONS

Material: Diecast zinc and plastic
Finish: Satin Chrome and gray
Dimensions: Height: 7 inches
Base Diameter: 5-1/8 inches.
Weight: 1-3/4 lbs.

WIRING

The switching of the Model 428 provides for control of the microphone circuit itself as well as for external relay-operated equipment. A typical arrangement is shown in Figure 1.

The microphone is normally shorted when wired as shown in Figure 1. When the switch is depressed, contacts are opened to permit operation of the microphone. When multiple microphones are used with the same amplifier input, the shorting connections on one microphone will short the others, as well. The switch should therefore be wired so that the contacts complete the microphone circuit instead of breaking the ground connection.

The other contacts actuate external relay equipment when the switch is depressed. Both make and break contacts are available. If the switch is used to break into an inductive circuit carrying substantial power, care should be taken to bypass the circuit at its source to prevent arcing.

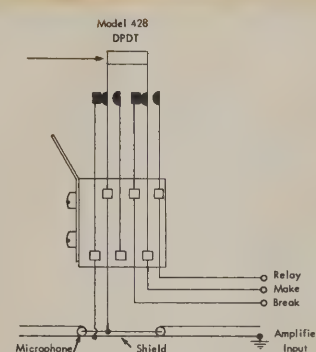


Figure 1- Model 428-Wiring Diagram

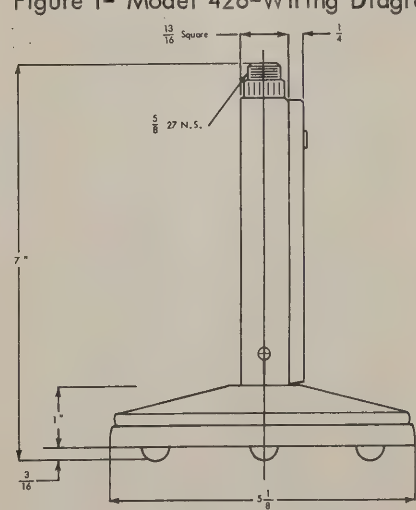


Figure 2- Model 428-Dimensions

428 STAND AND 448 BOOM MOUNT

Model 448 Swivel Boom Mount

The Model 448 microphone desk boom mount (see Figure 3) is designed specifically for the Model 648 microphone; this unit is used in applications where desk mounting is desired, and will hold the microphone 11-7/8 inches off the mounting surface. The shaft extends 4 inches below the mounting surface and has an integral swivel allowing the microphone to be swung out of the way when desired. The base is permanently secured by screws in the swivel flange with the MC-2 M cable connector extending through the mounting surface allowing cable to be attached with ease.

Figure 3- Model 448-Boom Mount

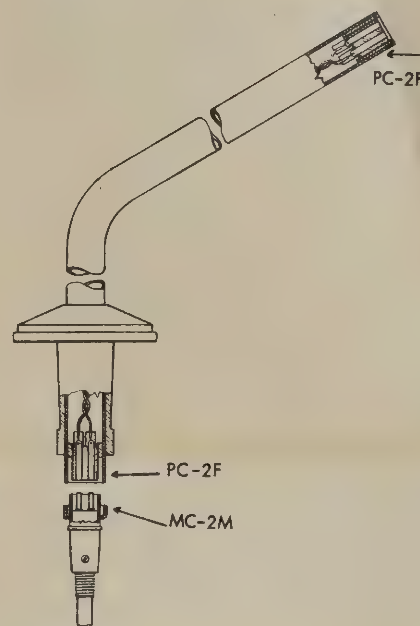


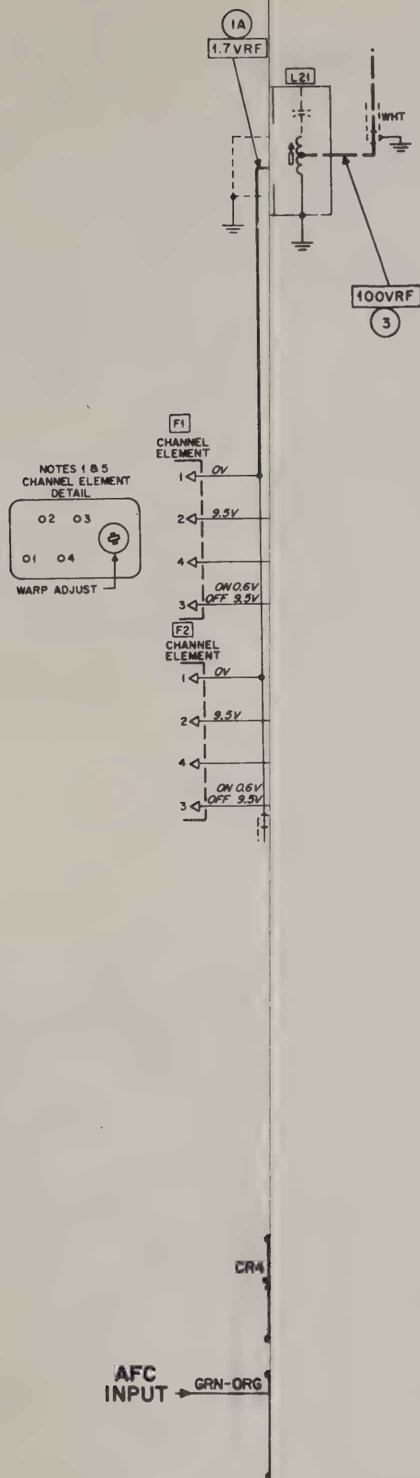
Figure 4- Model 448-Wiring Diagram

SPECIFICATIONS

Cable Connector:	Amphenol MC-2M
Dimensions:	Diameter: 5/8 inch Length: 20-9/16 inch with 62° bend 4-9/16 inch from base.
Material:	Steel
Finish:	Satin Chrome
Weight:	1 lb, 5 oz.

Warranty

The Models 428 microphone stand and the 448 swivel boom mount are guaranteed against defects in workmanship and materials.



RECEIVER

REFER TO RECEIVER SCHEMATIC
DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Multiplier Circuit Board Detail
For 4-Frequency Receivers
Motorola No. PEPS-1784-G
8/23/72- UP

Model 448 Swivel Boom Mount

The Model 448 microphone desk boom mount (see Figure 3) is designed specifically for the Model 648 microphone; this unit is used in applications where desk mounting is desired, and will hold the microphone 11-7/8 inches off the mounting surface. The shaft extends 4 inches below the mounting surface and has an integral swivel allowing the microphone to be swung out of the way when desired. The base is permanently secured by screws in the swivel flange with the MC-2 M cable connector extending through the mounting surface allowing cable to be attached with ease.

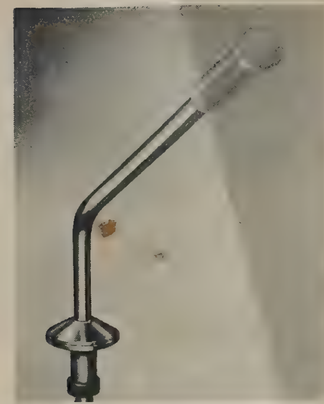


Figure 3- Model 448-Boom Mount

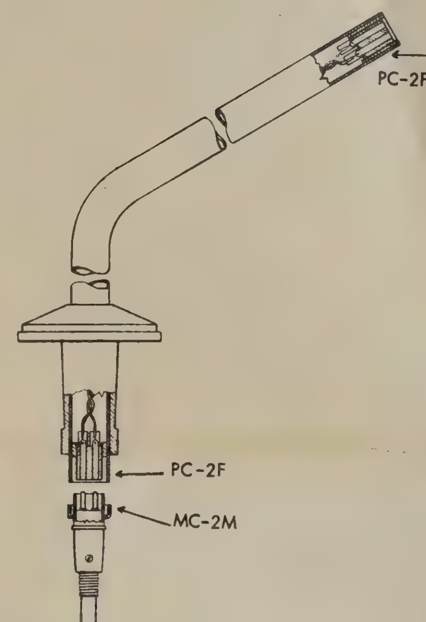


Figure 4- Model 448-Wiring Diagram

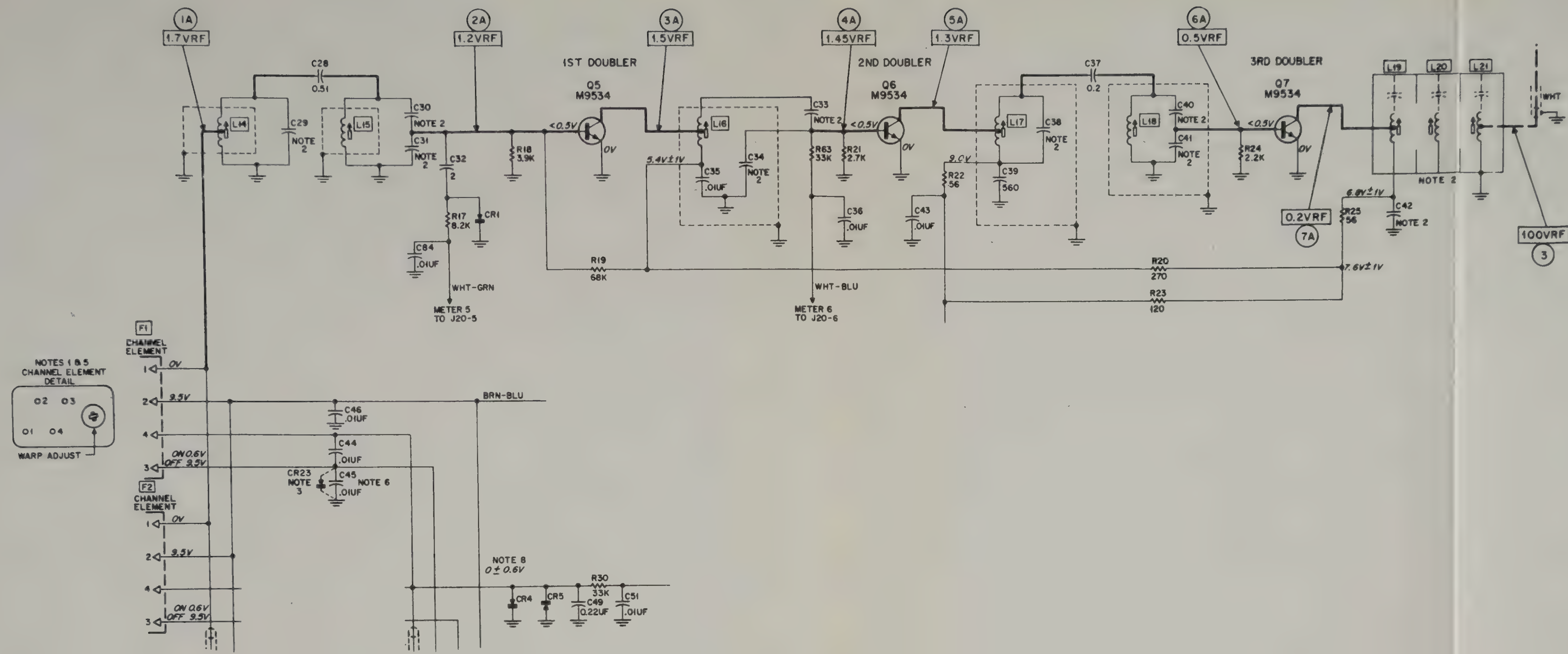
SPECIFICATIONS

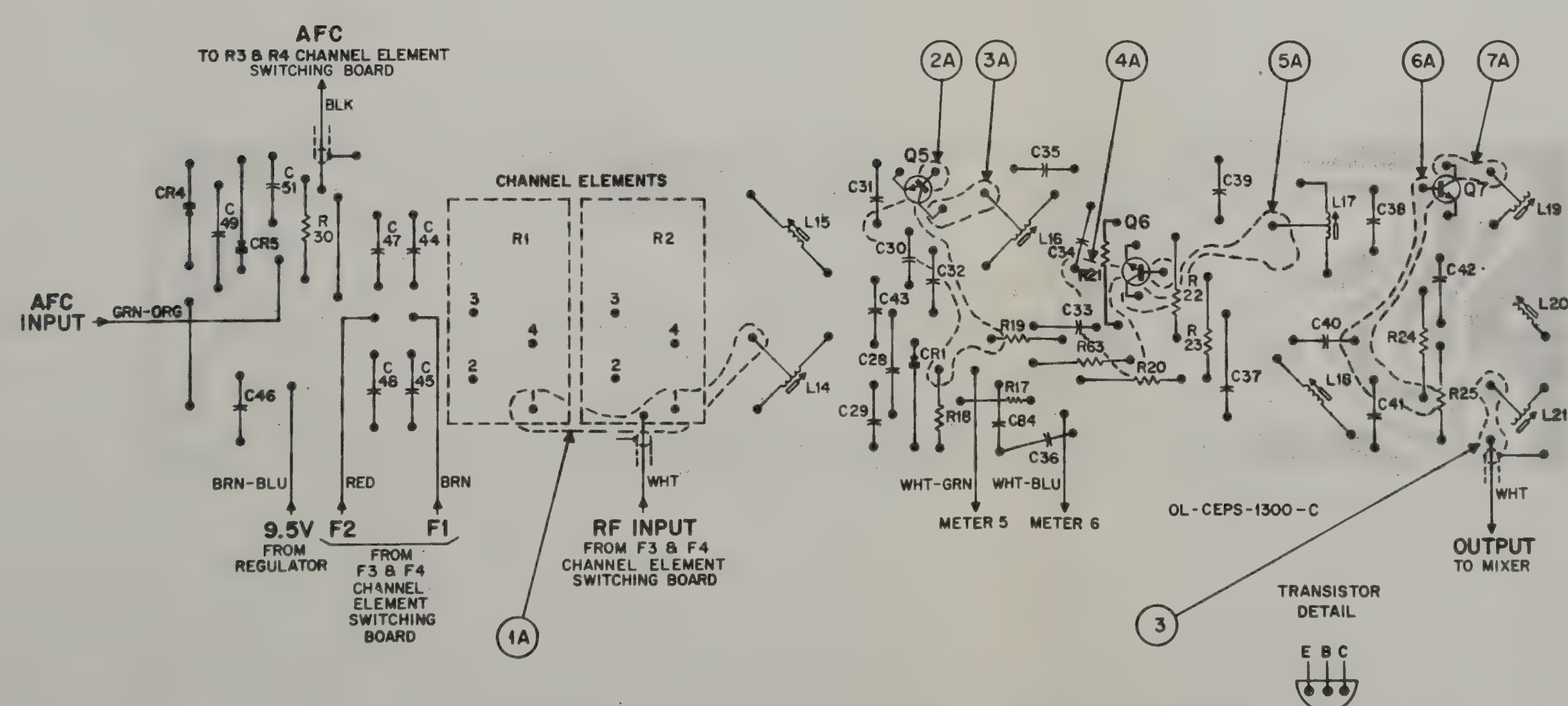
Cable Connector:	Amphenol MC-2M
Dimensions:	Diameter: 5/8 inch
	Length: 20-9/16 inch with 62° bend 4-9/16 inch from base.
Material:	Steel
Finish:	Satin Chrome
Weight:	1 lb, 5 oz.

Warranty

The Models 428 microphone stand and the 448 swivel boom mount are guaranteed against defects in workmanship and materials.

Printed in U.S.A. ELECTRO-VOICE, INC. Buchanan, Michigan Part No. 53206





RECEIVER

REFER TO RECEIVER SCHEMATIC
DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

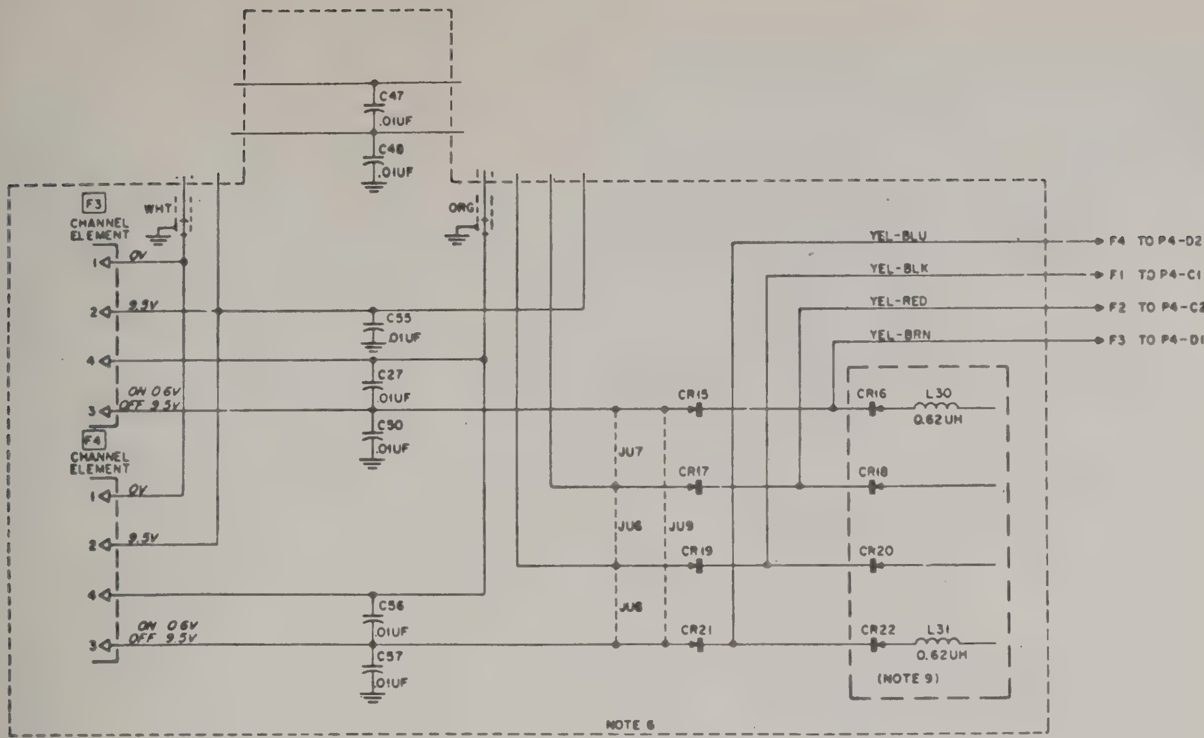
Multiplier Circuit Board Detail
For 4-Frequency Receivers
Motorola No. PEPS-1784-G
8/23/72- UP

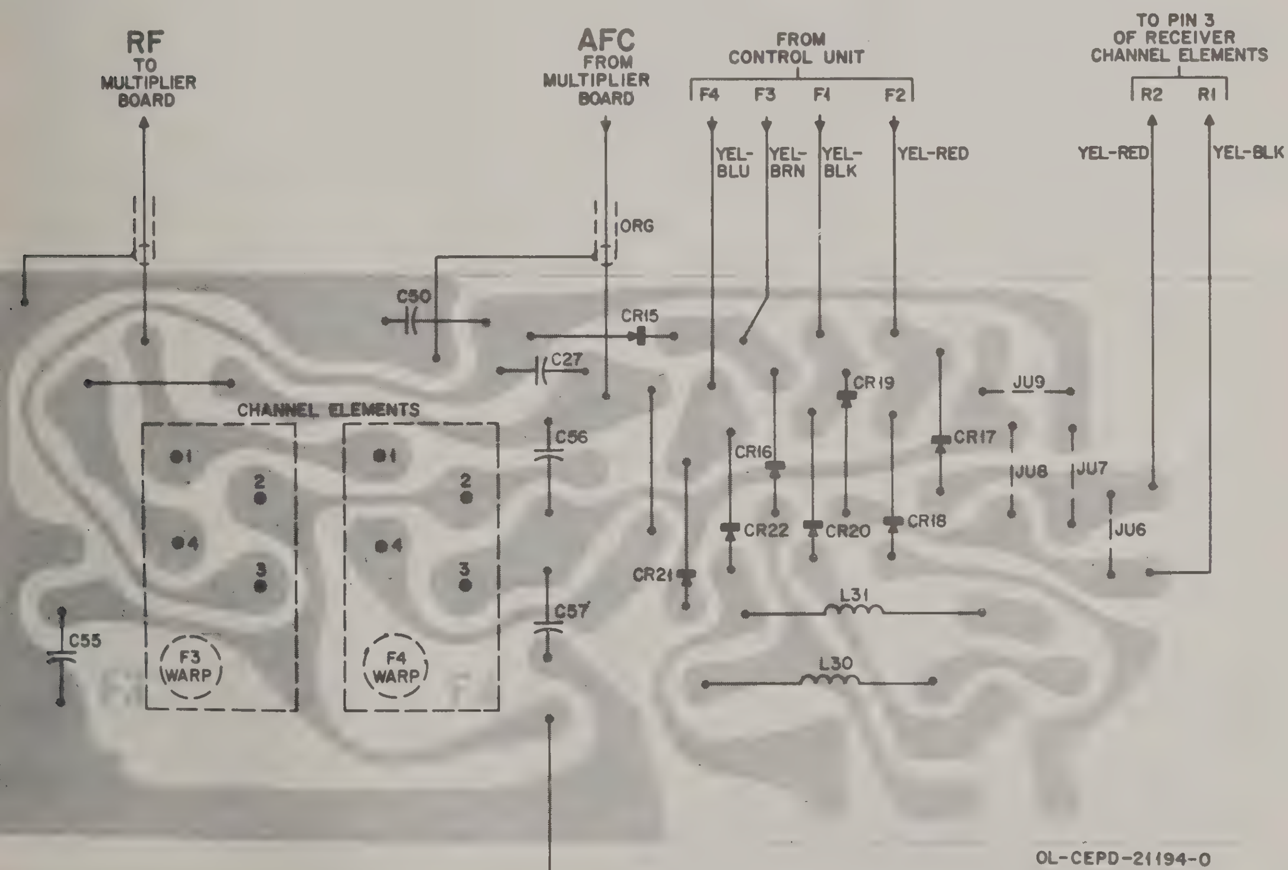
MOTOROLA PART NO.	DESCRIPTION
21-848525	16: NP0
21-840365	24: NP0
21-840365	24: NP0
21-82428B62	.01 uF +80-20%; 200 V
21-82428B59	.01 uF +80-20%; 200 V
21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
21-82428B59	.01 uF +80-20%; 200 V
21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
21-82428B59	.01 uF +80-20%; 200 V (multi-freq only)
8-82905G11	0.22 uF ±10%; 50 V
21-82428B59	.01 uF +80-20%; 200 V
21-82428B62	.01 uF +80-20%; 200 V
	SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
48-82921G02	germanium
48-82392B13	silicon
48-82392B13	silicon
48-82392B03	silicon (single-freq only)
	COIL, RF:
24-83857G01	BRN; 8-1/2 turns, tapped at 2-1/8 turns; incl tuning core
24-83857G02	RED; 8-1/2 turns; incl tuning core
24-83857G03	ORG; 6-1/2 turns, tapped at 7/8 turn; incl tuning core
24-83857G04	YEL; 3-1/2 turns, tapped at 7/8 turn; incl tuning core
24-83857G05	GRN; 3-1/2 turns; incl tuning core
1-80714B13	13-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
1-80718B56	12 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
1-80780A83	12-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
1-80727B55	11-3/4 turns; tapped at 1-3/4 turns
1-80727B57	10-5/8 turns; tapped at 1-3/4 turns
24-83858G05	14-1/4 turns
24-83858G03	13 turns
24-83858G02	13-5/8 turns
24-83858G14	12 turns
24-83858G17	11-5/8 turns
1-80714B14	15-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
1-80718B57	13-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
1-80780A84	13-7/8 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
1-80727B54	12-3/4 turns; tapped at 3-1/4 turns
1-80727B56	12 turns; tapped at 3-1/4 turns
	TRANSISTOR: (SEE NOTE)
48-869534	N-P-N; type M9534
48-869534	N-P-N; type M9534
48-869534	N-P-N; type M9534
	RESISTOR, fixed: ±10%; 1/4 W unl otherwise stated
6-185B90	8.2k; 1/8 W
6-185B86	3.9k; 1/8 W
6-185C02	68k; 1/8 W
6-129752	270
6-128688	2.7k
6-129860	56
6-129617	120
6-128689	2.2k
6-129860	56
6-127807	33k
6-127807	33k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	26-82221H01	SHIELD, coil: used with L14, L15
	26-82076C01	SHIELD, coil: used with L16, L17, L18
	1-80780A82	SHIELD, coil: used with L19, L20, L21

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Four-Frequency Receiver Channel Element and Switching Board Detail
Motorola No. PEPS-1163-B
1/21/71-UP

REVISIONS

PEPS-1784-G

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8748A TLN8749A	C39	WAS 21C82187B06, 560 pF	PARTS LIST
TLN8748A-1 TLN8749A-1 TLN4563A TLN4564A		430-450 MHz MODELS ADDED	
TLN4770A TLN4771A TLN4772A TLN4773A		470-494 MHz & 494-512 MHz MODELS ADDED	

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

LEGEND:
LL = 406-430 MHz
L = 430-450 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz

MULTIPLIER BOARD

TLN8748A (Single-Frequency: 406-430 MHz)
TLN4564A (Single-Frequency: 430-450 MHz)
TLN8750A (Single-Frequency: 450-470 MHz)
TLN4770 (Single-Frequency: 470-494 MHz)
TLN4771 (Single-Frequency: 494-512 MHz)
TLN8749A (Multi-Frequency: 406-430 MHz)
TLN4563A (Multi-Frequency: 430-450 MHz)
TLN8751A (Multi-Frequency: 450-470 MHz)
TLN4772 (Multi-Frequency: 470-494 MHz)
TLN4773 (Multi-Frequency: 494-512 MHz)

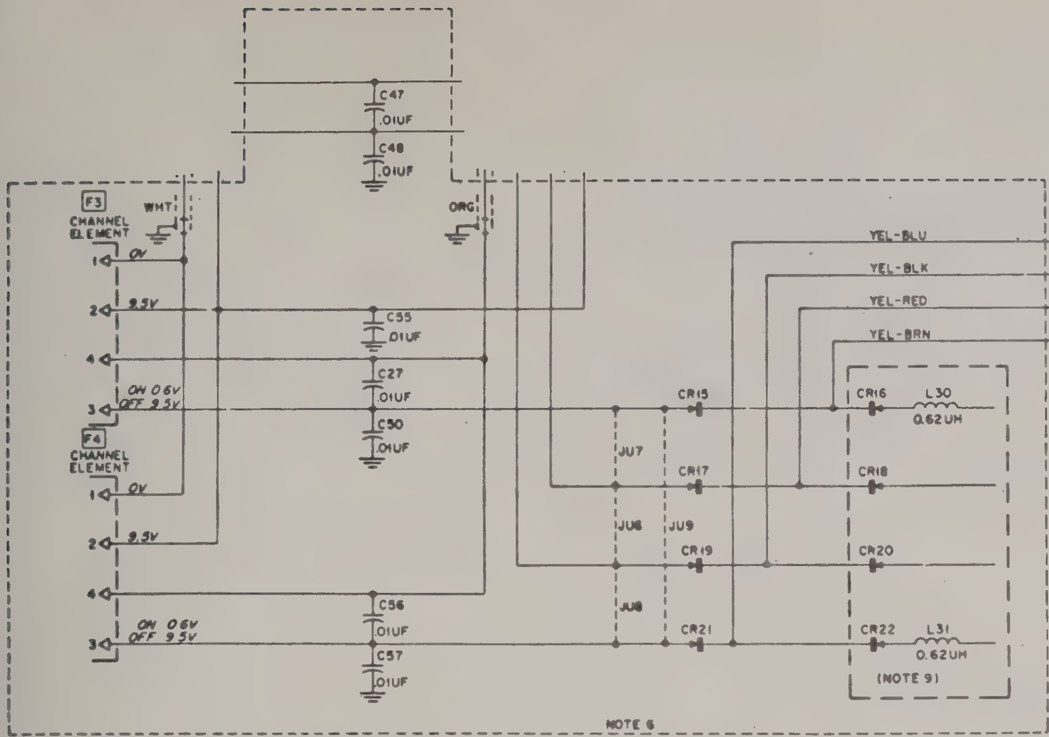
PL-1323-B

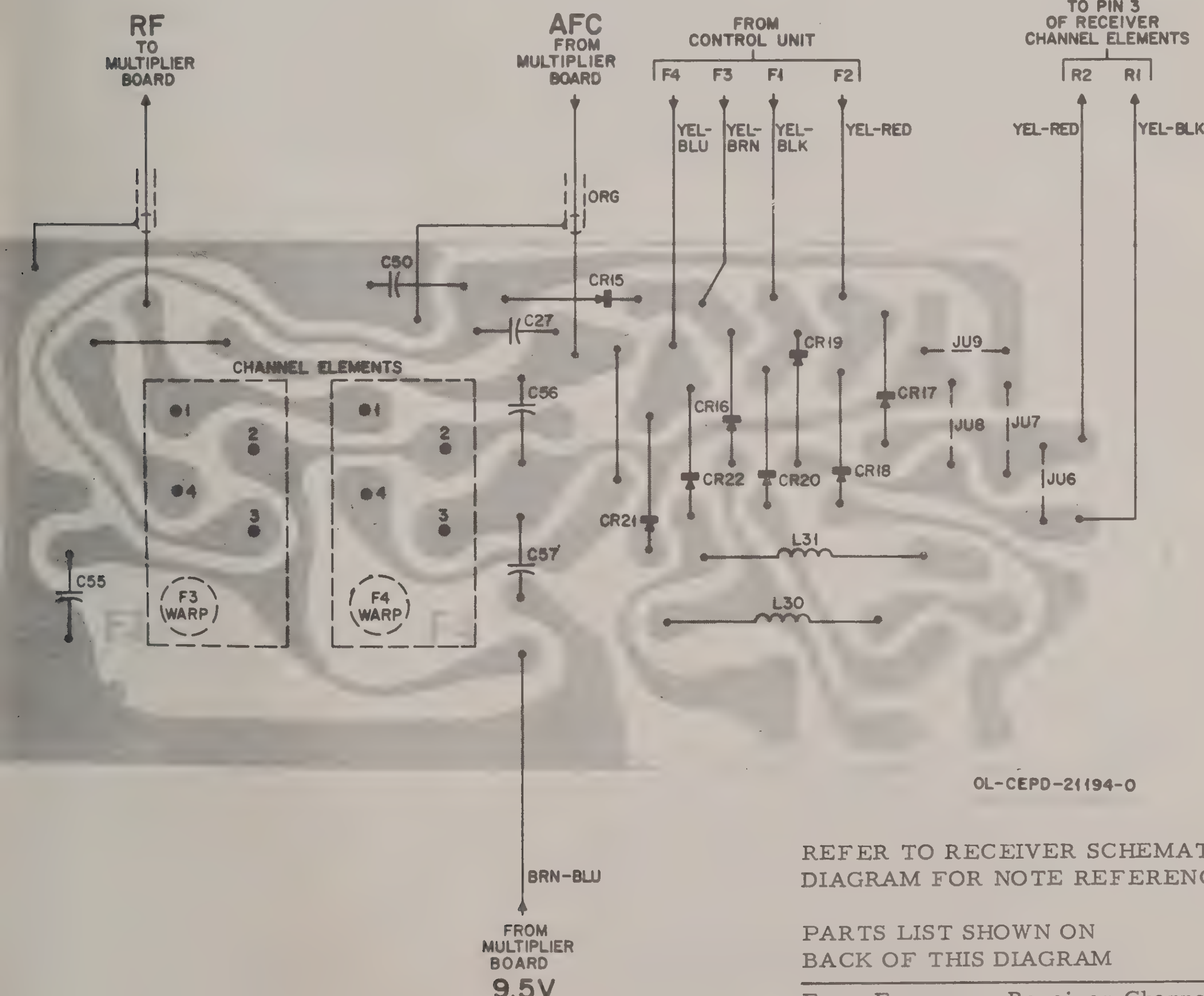
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF: ±5%: 500 V: unl otherwise stated
C28	21-82450B29	0.51: coded GRN-BRN-GRAY-GOLD
C29LL	21-83406D82	36: NP0
C29L	21-83406D71	33: NP0
C29M	21-114166	30 ±10%: NP0
C29H	21-82133G06	27: NP0 (single-freq)
C29HH	or21-840365	24: NP0 (multi-freq)
C30LL	21-840365	24: NP0 (single-freq)
C29HH	or21-82204B34	22: NP0 (single-freq)
C30LL	21-84493B27	51: 200 V: NP0
C30L	21-83406D87	43: NP0
C30M	21-82610C45	40: 100 V: NP0
C30H	21-82610C86	36: 200 V: NP0
C30HH	21-83406D19	33: NP0
C31LL	21-82610C09	120: 200 V: N220
C31L	21-82610C09	120: 200 V: N220
C31M	21-82610C44	100: 100 V: N220
C31H	21-82610C63	91: 200 V: N220
C31HH	21-84493B32	82: 200 V: N220
C32	21-857336	2 ±0.25 pF: NP0
C33LL	21-83406D83	12: N150
C33L	21-838686	10 ±5%; N150
C33M	21-859642	9 ±0.5 pF: N150
C33H	21-847873	8.2: N150
C33HH	21-847873	8.2: N150
C34LL	21-84493B29	47: 200 V: N470
C34L	21-83406D88	40; N470
C34M	21-859697	30: N470
C34H	21-124946	27: N470
C34HH	21-124946	27: N470
C35	21-832501	.01 uF +60-40%: 250 V
C36	21-82428B59	.01 uF +80-20%: 200 V
C37	21-82450B35	0.2 ±10%: coded RED-BLK-GRAY-SILVER
C38LL	21-83406D53	3.3 ±0.25 pF: NP0
C38L	21-83406D66	2.7 ±0.25 pF: NP0
C38M	21-857336	2 ±0.25 pF: NP0
C39LL	21-84493B14	68: 200 V: NP0
C39L	21-82187B06	560
C39M	21-82187B06	560
C39H	21-865922	390 ±10%
C39HH	21-865922	390 ±10%
C40LL	21-82204B03	6 ±0.5 pF: NP0
C40L	21-82204B03	6 ±0.5 pF: NP0
C40M	21-840850	4 ±0.5 pF: NP0
C40H	21-840850	4 ±0.5 pF: NP0
C40HH	21-83406D53	3.3 ±0.25 pF: NP0
C41LL	21-83406D73	7.5 ±0.5 pF: NP0
C41L	21-83406D65	5 ±0.25 pF: NP0
C41M	21-83406D65	5 ±0.25 pF: NP0
C41H	21-840847	5: NP0
C41HH	21-82355B39	4.7 ±0.25 pF: NP0
C42LL	21-84493B21	30: 200 V NP0
C42L	21-83406D67	22: NP0
C42M	21-848525	16: NP0
C42H	21-840365	24: NP0
C42HH	21-840365	24: NP0
C43	21-82428B62	.01 uF +80-20%: 200 V
C44	21-82428B59	.01 uF +80-20%: 200 V
C45	21-82428B59	.01 uF +80-20%: 200 V (multi-freq only)
C46	21-82428B59	.01 uF +80-20%: 200 V
C47	21-82428B59	.01 uF +80-20%: 200 V (multi-freq only)
C48	21-82428B59	.01 uF +80-20%: 200 V (multi-freq only)
C49	8-82905G11	0.22 uF ±10%: 50 V
C51	21-82428B59	.01 uF +80-20%: 200 V
C84	21-82428B62	.01 uF +80-20%: 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1	48-82921G02	germanium
CR4	48-82392B13	silicon
CR5	48-82392B13	silicon
CR23	48-82392B03	silicon (single-freq only)
		COIL, RF:
L14	24-83857G01	BRN; 8-1/2 turns, tapped at 2-1/8 turns; incl tuning core
L15	24-83857G02	RED; 8-1/2 turns; incl tuning core
L16	24-83857G03	ORG; 6-1/2 turns, tapped at 7/8 turn; incl tuning core
L17	24-83857G04	YEL; 3-1/2 turns, tapped at 7/8 turn; incl tuning core
L18	24-83857G05	GRN; 3-1/2 turns; incl tuning core
L19LL	1-80714B13	13-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
L19L	1-80718B56	12 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
L19M	1-80780A83	12-1/4 turns; tapped at 1-3/4 turns; requires 76-83419G02 CORE, tuning
L19H	1-80727B55	11-3/4 turns; tapped at 1-3/4 turns
L19HH	1-80727B57	10-5/8 turns; tapped at 1-3/4 turns
L20LL	24-83858G05	14-1/4 turns
L20L	24-83858G03	13 turns
L20M	24-83858G02	13-5/8 turns
L20H	24-83858G14	12 turns
L20HH	24-83858G17	11-5/8 turns
L21LL	1-80714B14	15-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
L21L	1-80718B57	13-1/2 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
L21M	1-80780A84	13-7/8 turns; tapped at 3-1/4 turns; requires 76-83419G02 CORE, tuning
L21H	1-80727B54	12-3/4 turns; tapped at 3-1/4 turns
L21HH	1-80727B56	12 turns; tapped at 3-1/4 turns
		TRANSISTOR: (SEE NOTE)
Q5	48-869534	N-P-N; type M9534
Q6	48-869534	N-P-N; type M9534
Q7	48-869534	N-P-N; type M9534
		RESISTOR, fixed: ±10%: 1/4 W unl otherwise stated
R17	6-185B90	8.2k; 1/8 W
R18	6-185B86	3.9k; 1/8 W
R19	6-185C02	68k; 1/8 W
R20	6-129752	270
R21	6-128688	2.7k
R22	6-129860	56
R23	6-129617	120
R24	6-128689	2.2k
R25	6-129860	56
R30	6-127807	33k
R63	6-127807	33k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	26-82221H01	SHIELD, coil: used with L14, L15
	26-82076C01	SHIELD, coil: used with L16, L17, L18
	1-80780A82	SHIELD, coil: used with L19, L20, L21

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Four-Frequency Receiver Channel Element and Switching Board Detail
Motorola No. PEPS-1163-B
1/21/71-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

Channel Element (Receiver with AFC) PL-423-O

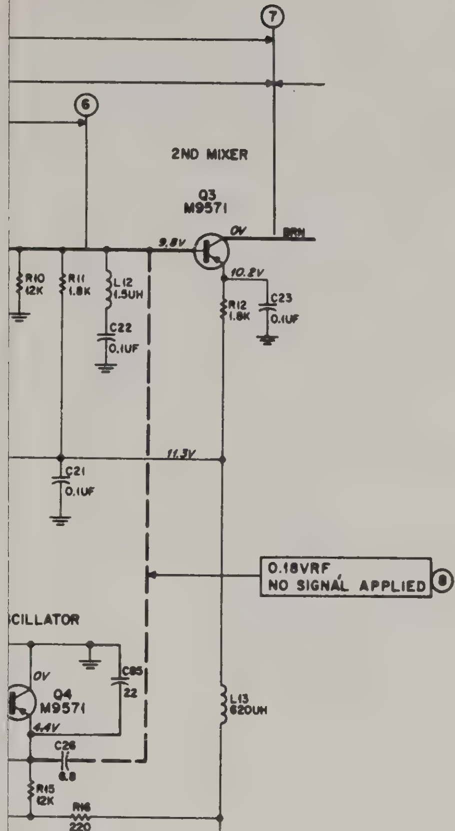
	CER-106B	CHANNEL ELEMENT, receiver control: capable of ±.0002% frequency stability in receivers with AFC; consists of: TLN8968A Oscillator Module RES-106B Resonator Module (crystal)

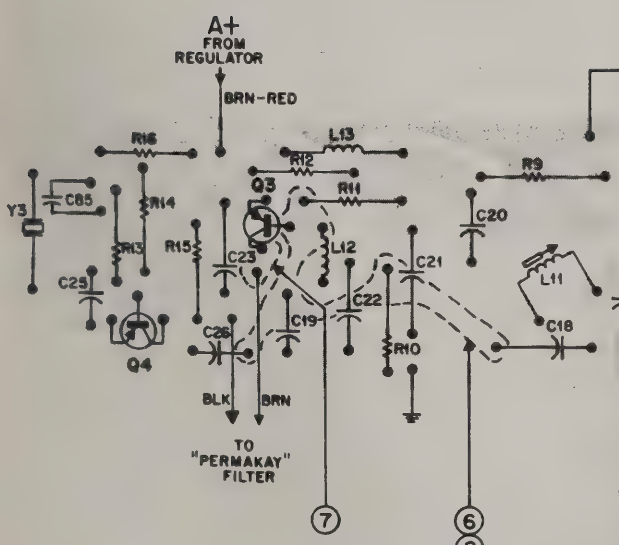
TLN8757A Four-frequency Receiver Board PL-321-O

		CAPACITOR, fixed:
C27, 50, 55, 56, 57	21D82428B[illegible]	.01 uF +80-20%; 200 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR15 thru 22	48C82392B03	silicon
		COIL, RF:
L30, 31	24V80900A61	choke: 0.62 uH

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.





RECEIVER

REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8752A 1st IF and
2nd Oscillator Circuit Board Detail
Motorola No. PEPS-1293-F
8/23/72-UP

PARTS LIST

Channel Element (Receiver with AFC) PL-423-O

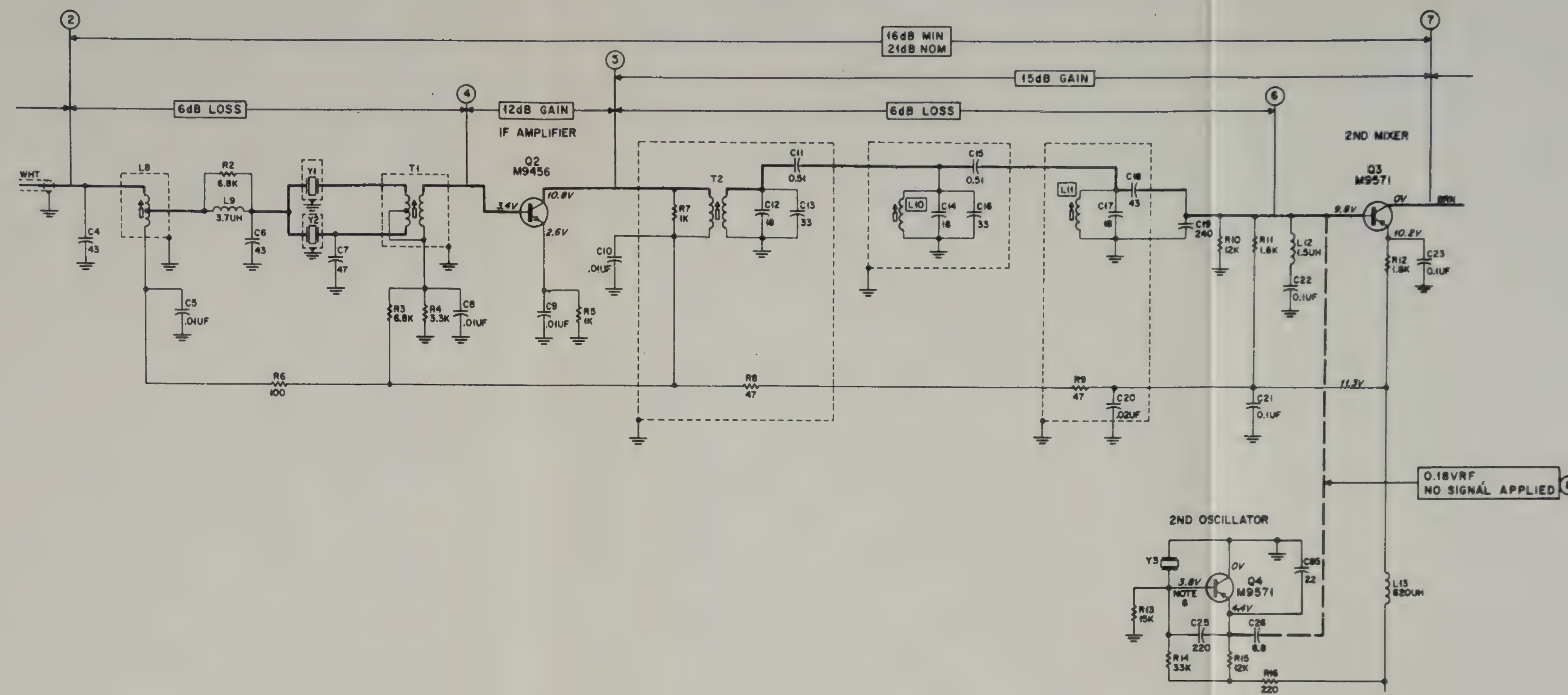
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	CER-106B	CHANNEL ELEMENT, receiver control: capable of ±.0002% frequency stability in receivers with AFC; consists of: TLN8968A Oscillator Module RES-106B Resonator Module (crystal)

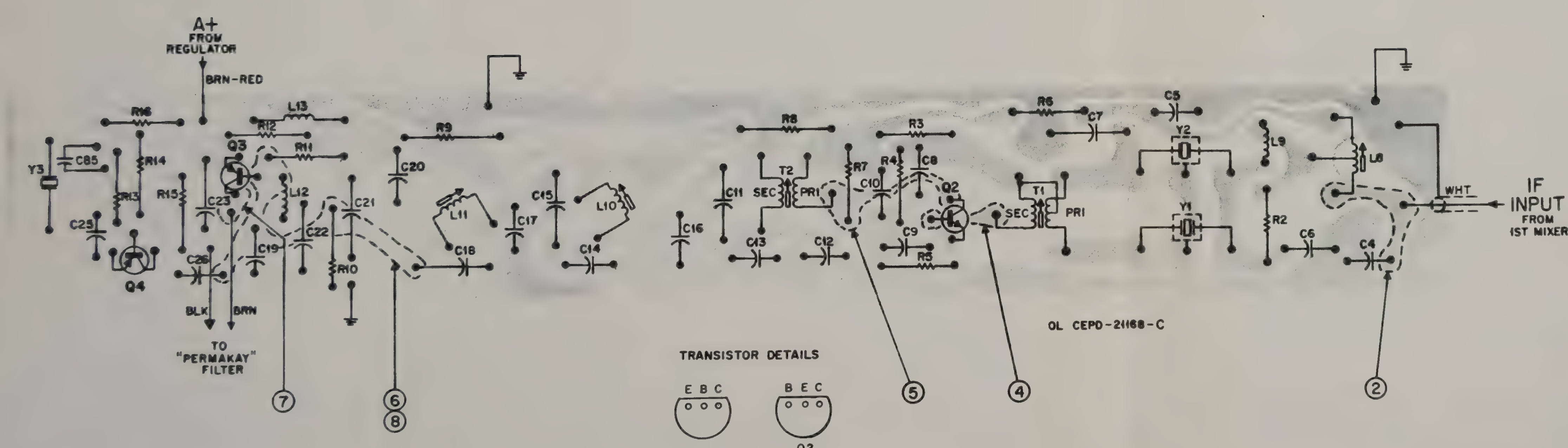
TLN8757A Four-frequency Receiver Board PL-321-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<u>CAPACITOR, fixed:</u>
C27, 50, 55, 56, 57	21D82428B5[illegible]	.01 uF +80-20%; 200 v
		<u>SEMICONDUCTOR DEVICE, diode:</u> (NOTE)
CR15 thru 22	48C82392B03	silicon
		<u>COIL, RF:</u>
L30, 31	24V80900A61	choke; 0.62 uH

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

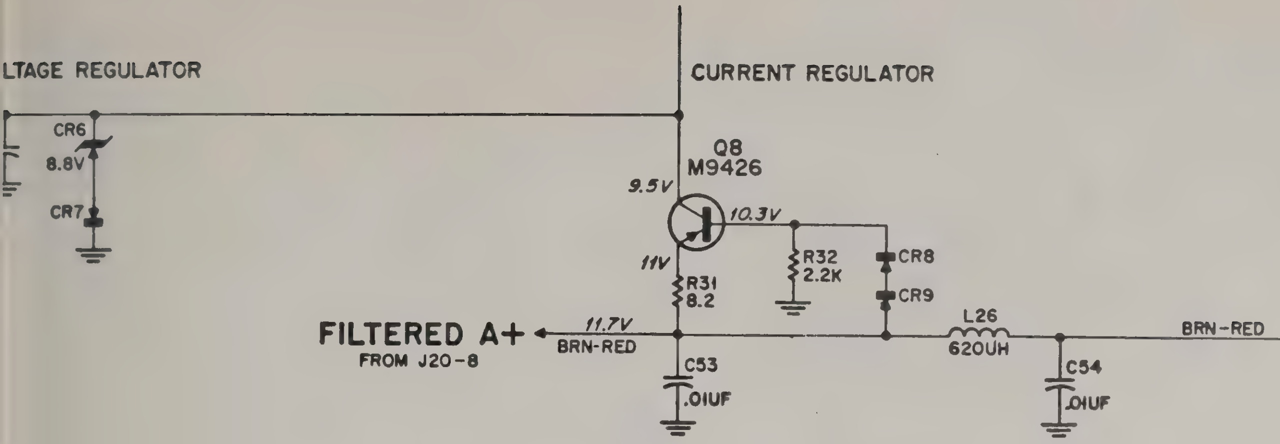


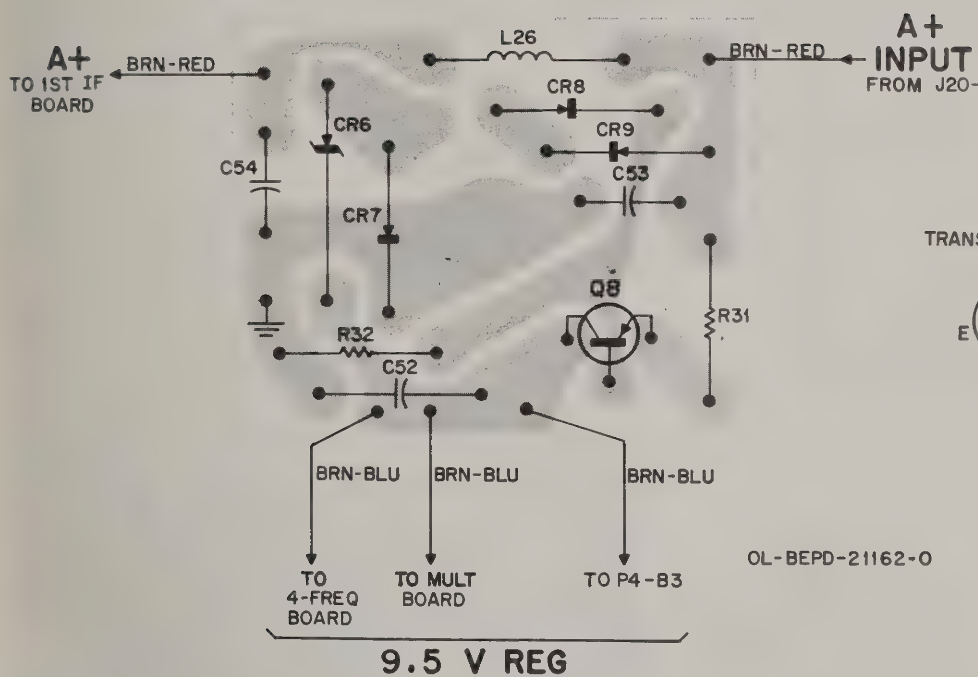


REFER TO RECEIVER SCHEMATIC
DIAGRAM FOR NOTE REFERENCES

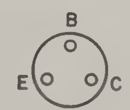
PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

TLN8752A 1st IF and
2nd Oscillator Circuit Board Detail
Motorola No. PEPS-1293-F
8/23/72- UP





TRANSISTOR DETAIL



OL-BEPD-21162-0

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLN8746A Voltage Regulator
Circuit Board Detail
Motorola No. PEPS-1166-O
1/21/71-UP

REVISIONS

PEPS-1293-F

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8752A-1 TLN8752AL-1 TLN8753A-1 TLN8753AL-1	C24	20 pF; 21D82610C22 REMOVED	FROM BASE OF Q4 TO GROUND
	C85	ADDED	Q4 EMITTER

PARTS LIST

1ST IF & 2ND Oscillator Board

TLN8752A (11.7 MHz, standard IF, high side injection)
TLN8752AL (11.7 MHz, standard IF, low side injection)
TLN8753A (11.6 MHz, shifted IF, high side injection)
TLN8753AL (11.6 MHz, shifted IF, low side injection)

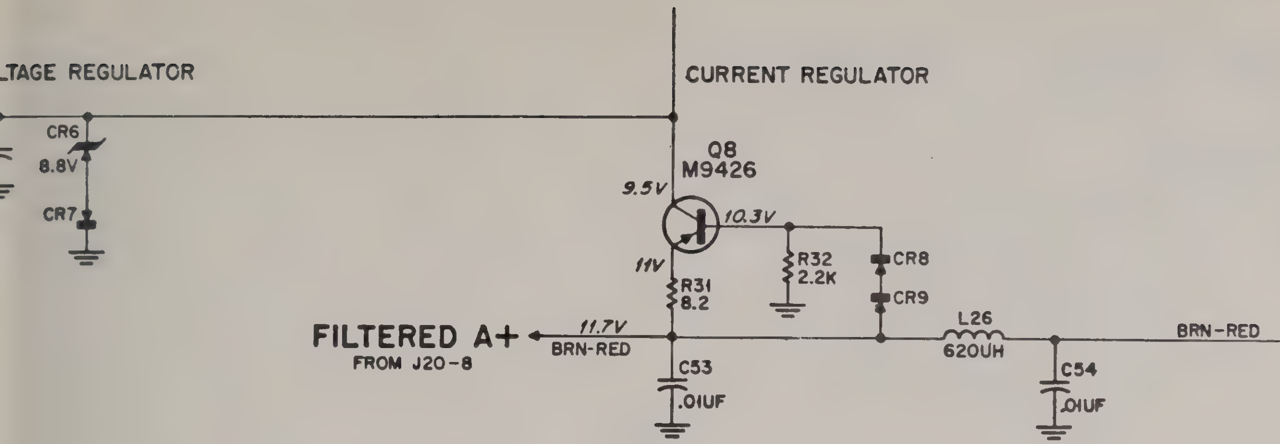
PL-318-C

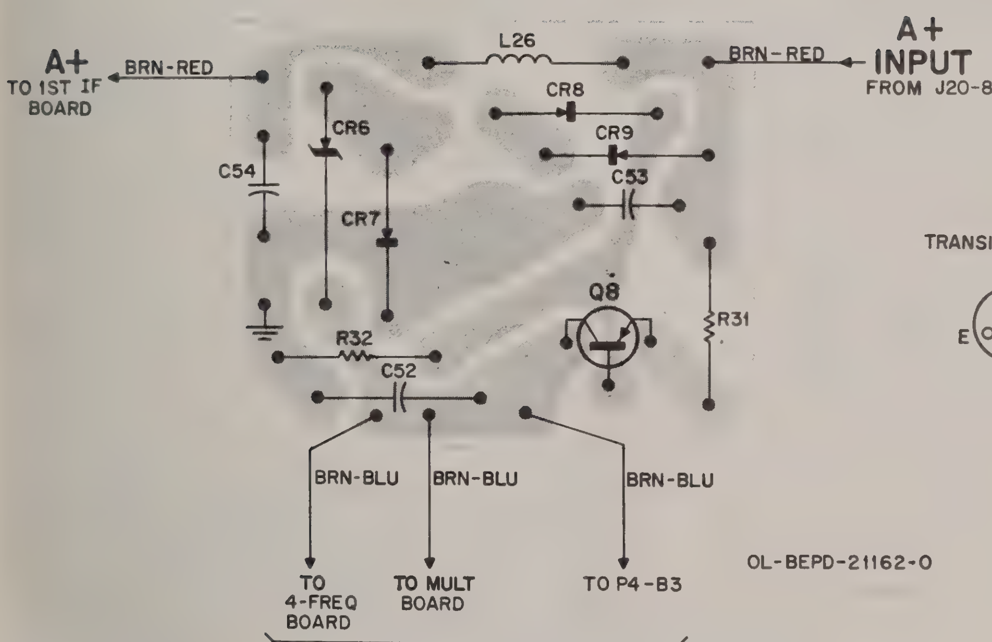
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 50 v; unl. stated
C4	21D82204B28	43; 200 v; N080
C5, 8, 9, 10	21D82428B59	.01 uF +80-20%; 200 v
C6	21D82204B29	43 ±3%; 200 v; NP0
C7	21D83406D18	47; N150
C11, 15	21D82450B29	0.51
C12, 14, 17	21D82133G44	18; N330
C13, 16	21D83406D19	33; NP0
C18	21D82133G52	43; NP0
C19	21K840048	240
C20	21D82428B26	.02 uF +80-20%; 200 v
C21, 23	8D83293B01	0.1 uF ±10%; 50 v
C22	21C82372C01	0.1 uF +80-20%; 25 v
C25	21K859942	220
C26	21D83406D10	6.8 ±0.25 pF; NP0
C85	21R124554	22; 500 V; NP0
		COIL, RF:
L8	24E83879G01	coded BRN
L9	24C82835G21	choke; 3.7 uH
L10, 11	24E83879G04	coded YEL
L12	24D82135G04	choke; 1.5 uH
L13	24D82135G08	choke; 620 uH
		TRANSISTOR: (SEE NOTE I)
Q2	48R869456	N-P-N; type M9456
Q3, 4	48R869571	P-N-P; type M9571
		RESISTOR, fixed ±10%; 1/4 w; unl. stated
R2, 3	6S128687	6.8K
R4	6S129231	3.3K
R5, 7	6S127802	1K
R6	6S129753	100
R8, 9	6S129233	47
R10, 15	6S129230	12K
R11, 12	6S129269	1.8K
R13	6S127805	15K
R14	6S127807	33K
R16	6S127800	220
		TRANSFORMER, RF:
T1	24E83879G02	coded RED; incl. tuning core
T2	24E83879G03	coded ORG; incl. tuning core
		CRYSTAL UNIT, quartz: (SEE NOTE II)
Y1		type FSD; See Following
	48D84228C38	11.70625 MHz (TLN8752A, AL)
	or48D84228C25	11.60625 MHz (TLN8753A, AL)
Y2		type FSD; See Following
	48D84228C36	11.6945 MHz (TLN8752A, AL)
	or48D84228C23	11.5945 MHz (TLN8753A, AL)
Y3		for standard IF: type GN; See Following
	48D84229C17	12.155 MHz (TLN8752A)
	or48D84229C13	11.245 MHz (TLN8752AL)
		for shifted IF: type GN; See Following
	48D84229C21	12.055 MHz (TLN8753A) or
	or48D84229C22	11.145 MHz (TLN8753AL)
		NOTE Standard IF = 11.7 MHz Shifted IF = 11.6 MHz

NOTE:

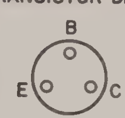
I. Replacement transistors must be ordered by Motorola part number only for optimum performance.

II. When ordering crystal units, specify carrier frequency, crystal frequency and crystal type number.





9.5 V REG



OL-BEPD-21162-0

RECEIVER

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLN8746A Voltage Regulator
Circuit Board Detail
Motorola No. PEPS-1166-O
1/21/71-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

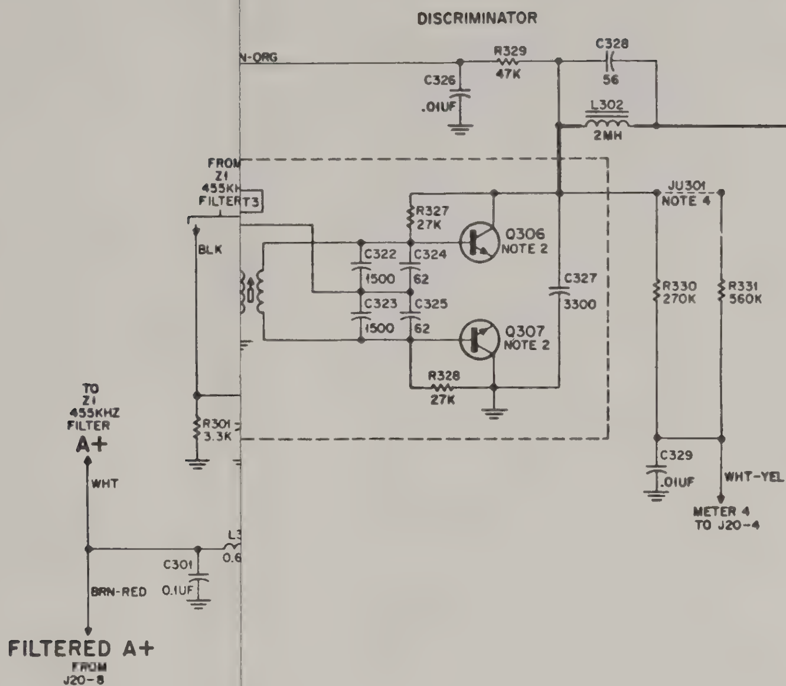
PARTS LIST

TLN8746A Regulator Board PL-323-O

		CAPACITOR, fixed
C52	8D82905G30	0.1 uF ±10%; 50 v
C53	21D82428B59	.01 uF ±20%; 200 v
C54	21D82428B62	.01 uF ±20%; 200 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6	48D82533D10	silicon; zener type
CR7, 8, 9	48C82392B03	silicon
		COIL, RF
L26	24D82135G08	choke; 620 uH
		TRANSISTOR: (SEE NOTE)
Q8	48R869426	P-N-P; type M9426; does not incl. 14B83878G01 INSULATOR, mounting
		RESISTOR, fixed:
R31	6S124B67	8.2 ±5%; 1/4 w
R32	6S128689	2.2K ±10%; 1/4 w

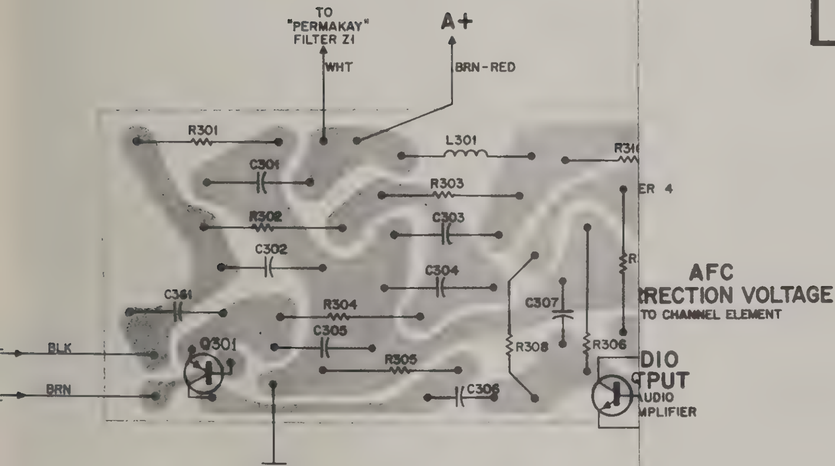
NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



FOR MODELS TLN8747A AND TLN8747AL SUFFIX -2 OR LATER, REFER TO CIRCUIT BOARD DETAIL PEPS-3325.

EPS-3326-O



REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8747A-1 & TLN8747AL-1
455 kHz IF Amplifier Circuit Board Detail
Motorola No. PEPS-1167-B
1/21/71-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

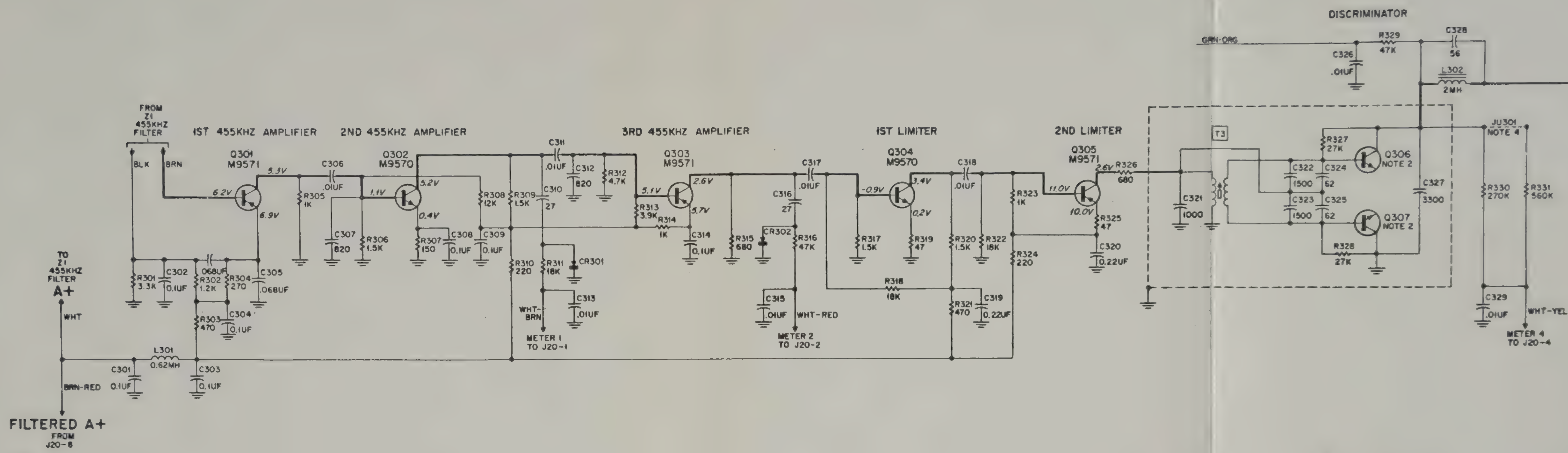
PARTS LIST

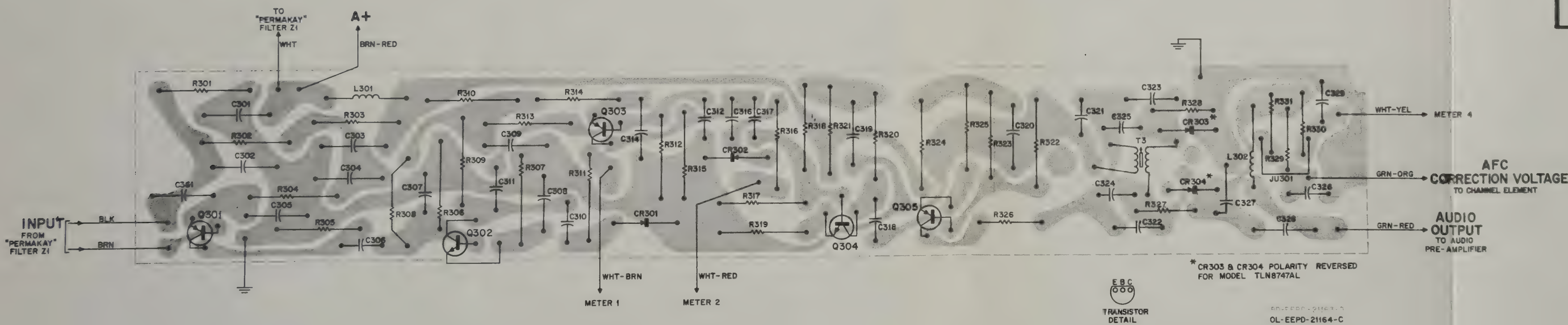
TLN8746A Regulator Board PL-323-O

		CAPACITOR, fixed:
C52	8D82905G30	0.1 uF ±10%; 50 v
C53	21D82428B59	.01 uF ±20%; 200 v
C54	21D82428B62	.01 uF ±20%; 200 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6	48D82533D10	silicon; zener type
CR7, 8, 9	48C82392B03	silicon
		COIL, RF
L26	24D82135G08	choke; 620 uH
		TRANSISTOR: (SEE NOTE)
Q6	48R869426	P-N-P; type M9426; does not incl. 14B83878G01 INSULATOR, mounting
		RESISTOR, fixed:
R31	6S124B67	8.2 ±5%; 1/4 w
R32	6S128689	2.2K ±10%; 1/4 w

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





FOR MODELS TLN8747A AND TLN8747AL SUFFIX -2 OR LATER, REFER TO CIRCUIT BOARD DETAIL PEPS-3325.

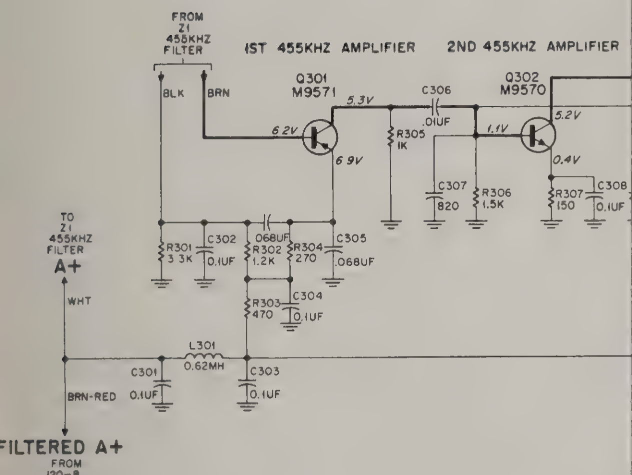
EPS-3326-O

REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

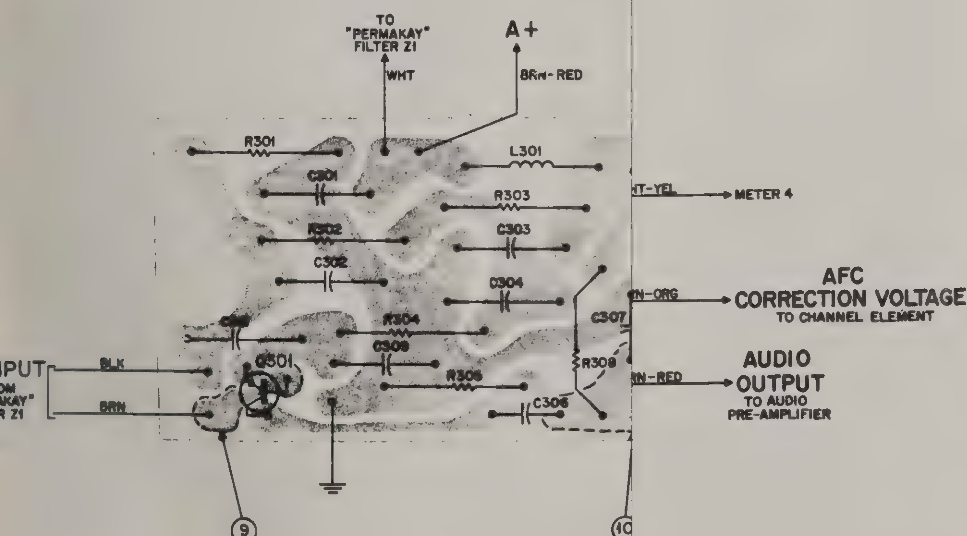
TLN8747A-1 & TLN8747AL-1
455 kHz IF Amplifier Circuit Board Detail
Motorola No. PEPS-1167-B
1/21/71-UP

RECEIVER



FOR MODELS TLN8747A AND TLN8747AL SUFFIX -1 OR EARLIER. REFER TO CIRCUIT BOARD DETAIL PEPS-1167.

EPS-3327-O



REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8747A-2 & TLN8747AL-2
455 kHz IF Amplifier
Circuit Board Detail
Motorola No. PEPS-3325-D
8/23/72- UP

REVISIONS

PEPS-1167-B

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8747A-1 TLN8747AL-1	C313	REMOVED (WAS 21D82428B59, .01 uF CONNECTED BE-TWEEN GROUND AND JUNCTION OF R311 AND WHT-BRN METER -1 LEAD)	CENTER OF BOARD
	C315	REMOVED (WAS 21D82428B59, .01 uF CONNECTED BE-TWEEN GROUND AND JUNCTION OF R316 AND WHT-RED METER -2 LEAD)	CENTER OF BOARD
TLN8747A-2 TLN8747AL-2		EXTENSIVE CIRCUIT CHANGES	REFER TO PEPS-3325-O

PARTS LIST

TLN8747A 455 kHz IF Board
TLN8747AL 455 kHz IF Board (NOTE II)

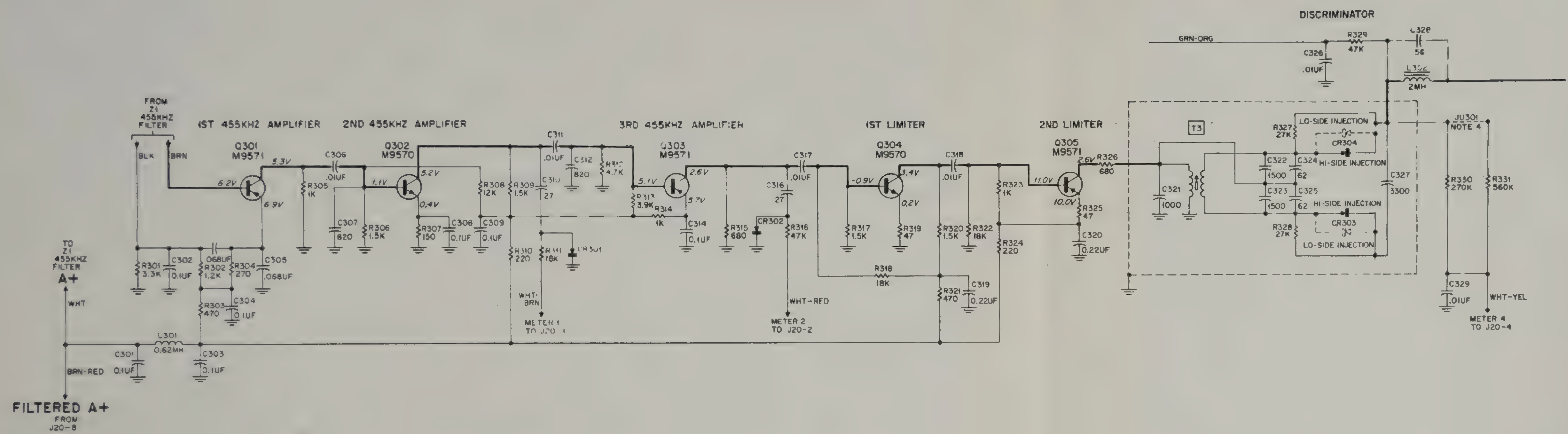
PL-322-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; ±10%; 50 v; unl. stated
C303, 304, 309	8C82095G06	0.1; 200 v
C302	8D83813H04	0.1
	or 8D82905G07	0.1
C308, 314, 301	21C82372C01	0.1 +80-20%; 25 v
C305, 361	8D82905G04	.068
C306, 311, 317, 318, 326, 329	21D82428B59	.01 +80-20%; 200 v
C307, 312	21C82187B17	820 pF, 500 v
C310, 316	21D82133G23	27 pF; 500 v NP0
C319, 320	8D83813H09	0.22
	or 8D82905G11	0.22
C321	21E82537B38	1000 pF ±3%; 100 v
C322, 323	21E82537B39	1500 pF ±2%; 100 v
C324, 325	21D83406D20	62 pF ±5%; 500 v; N1500
C327	21D82187B25	3300 pF; 500 v
C328	21K859219	56 pF ±5%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE I)
CR301, 302	48C82921G01	germanium
		COIL, RF:
L301	24D82135G08	choke; 0.62 mH
L302	24D82135G07	choke; 2 mH
		TRANSISTOR: (SEE NOTE I)
Q301, 303, 305	48R869571	P-N-P; type M9571
Q302, 304	48R869570	N-P-N; type M9570
Q306, 307	48R869570	N-P-N; type M9570 (TLN8747A)
	or 48R869571	P-N-P; type M9571 (TLN8747AL)
		RESISTOR, fixed: ±10%; 1/2 w; unl. stated
R301	6S5581	3.3K
R302	6S6393	1.2K
R303, 321	6S6090	470
R304	6S6432	270
R305, 314 323	6S6229	1K
R306, 309, 317, 320	6S6038	1.5K
R307	6S6373	150
R308	6S6394	12K
R310, 324	6S6270	220
R311, 318, 322	6S5591	18K
R312	6S6080	4.7K
R313	6S5659	3.9K
R315	6S6040	680
R316	6S6048	47K
R319, 325	6S5550	47
R326	6S128599	680; 1/4 w
R327, 328	6S129886	27K ±5%; 1/4 w
R329	6S128902	47K; 1/4 w
R330	6S129227	270K; 1/4 w
R331	6S129247	560K; 1/4 w
		TRANSFORMER, discriminator;
T3	24V80906A42	coded RED; incl. 76B82572G03 CORE, tuning

NOTES:

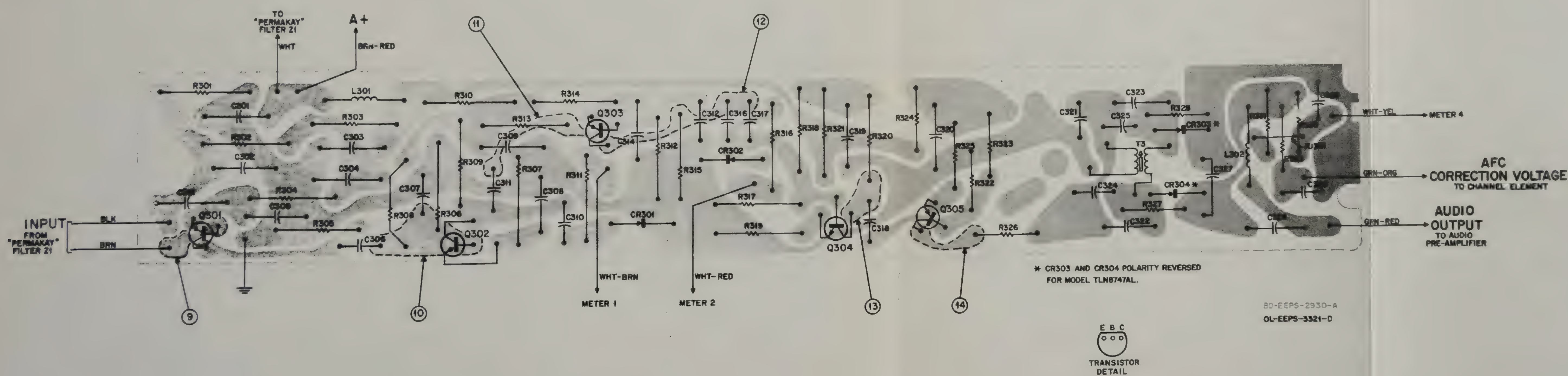
I. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

II. TLN8747AL used in receivers which employ low-side injection in high IF board.



FOR MODELS TLN8747A AND TLN8747AL SUFFIX -1 OR EARLIER. REFER TO CIRCUIT BOARD DETAIL PEPS-1167.

EPS-3327-O

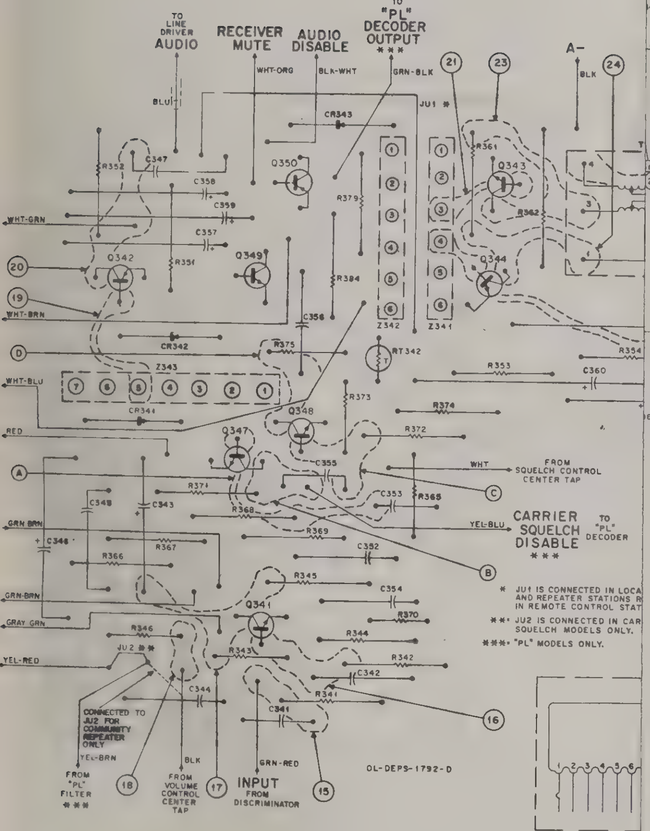


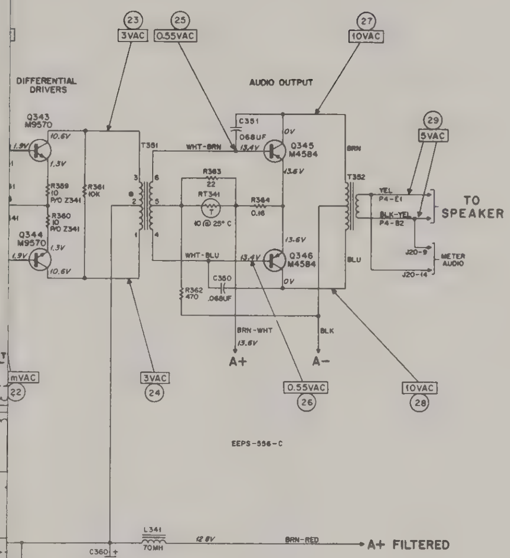
REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8747A-2 & TLN8747AL-2
455 kHz IF Amplifier
Circuit Board Detail
Motorola No. PEPS-3325-D
8/23/72- UP

RECEIVER





REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8783A-2 Audio and Squelch Circuit Board Detail
Motorola No. PEPS-1793-E
8/23/72- UP

PARTS LIST

TLN8747A 455 kHz IF Board
TLN8747AL 455 kHz IF Board (NOTE II) PL-779-O

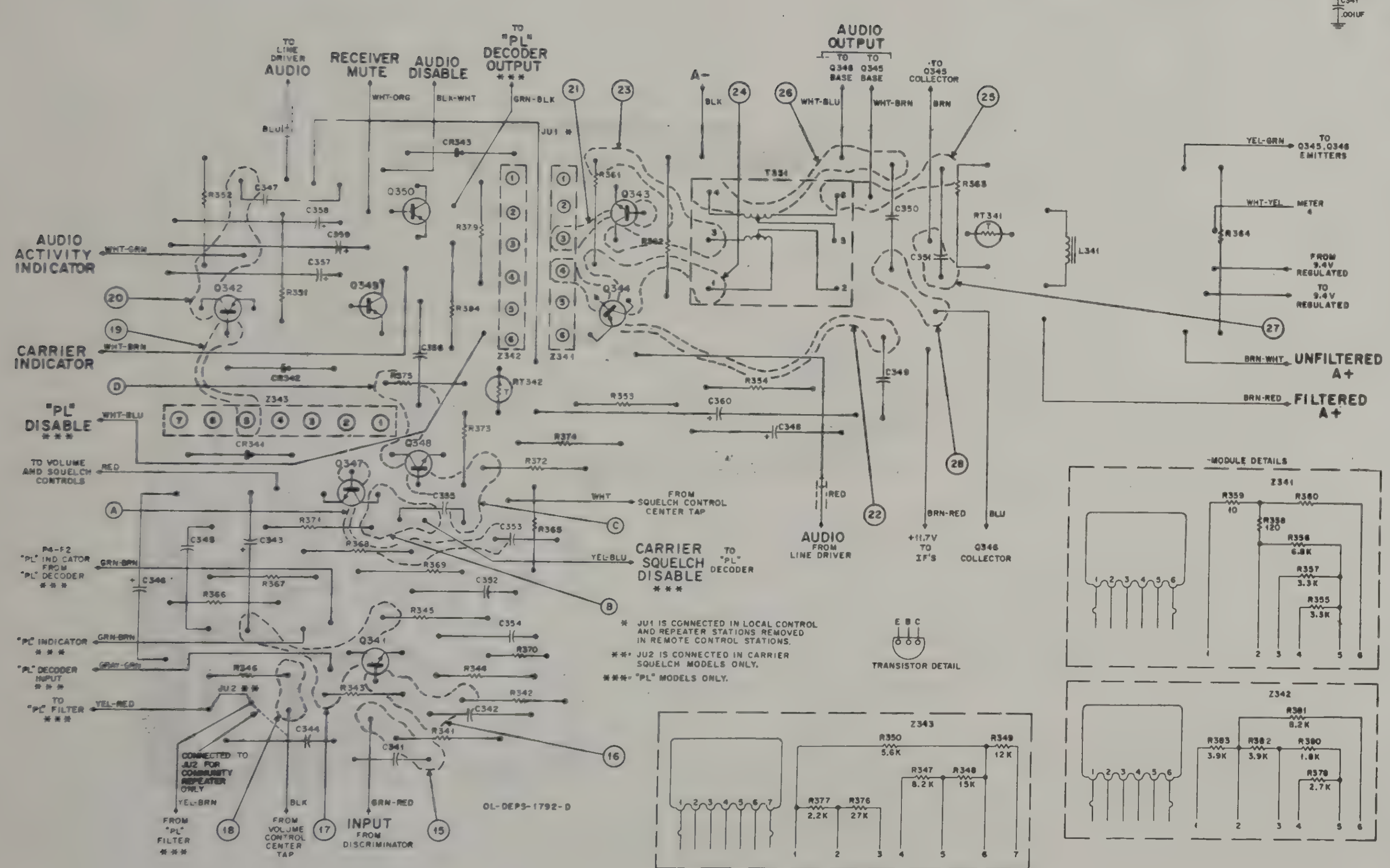
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; ±10%; 50 V; unl. stated
C303, 304,309	8C82095G06	0.1; 200 V
C302	8D83813H04	0.1
	or8D82905G07	0.1
C308, 314, 301	21C82372C01	0.1 +80-20%; 25 V
C305, 361	8D82905G04	.068
C306, 311, 317, 318, 326, 329	21D82428B59	.01 +80-20%; 200 V
C307, 312	21C82187B17	820 pF; 500 V
C310, 316	21D82133G23	27 pF; 500 V NP0
C319, 320	8D83813H09	0.22
	or8D82905G11	0.22
C321	21E82537B38	1000 pF ±3%; 100 V
C322, 323	21E82537B39	1500 pF ±2%; 100 V
C324, 325	21D83406D17	62 pF ±5%; 500 V N1750
C327	21D82187B25	3300 pF; 500 V
C328	21K859219	56 pF ±5%; 500 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE I)
CR301, 302	48C82921G01	germanium
CR303, 304	48C83654H02	silicon (NOTE III)
		COIL, RF:
L301	24D82135G08	choke; 0.62 mH
L302	24D82135G07	choke; 2 mH
		TRANSISTOR: (SEE NOTE I)
Q301, 303, 305	48R869571	P-N-P; type M9571
Q302, 304	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±10%; 1/2 W; unl. stated
R301	6S5581	3.3K
R302	6S6393	1.2K
R303, 321	6S6090	470
R304	6S6432	270
R305, 314, 323	6S6229	1K
R306, 309, 317, 320	6S6038	1.5K
R307	6S6373	150
R308	6S6394	12K
R310, 324	6S6270	220
R311, 318, 322	6S5591	18K
R312	6S6080	4.7K
R313	6S5659	3.9K
R315	6S6040	680
R316	6S6048	47K
R319, 325	6S5550	47
R326	6S128599	680; 1/4 W
R327, 328	6S129886	27K ±5%; 1/4 W
R329	6S128902	47K; 1/4 W
R330	6S129227	270K; 1/4 W
R331	6S129247	560K; 1/4 W
		TRANSFORMER, discriminator;
T3	24V80906A42	coded RED; incl. 76B82572G03 CORE, tuning

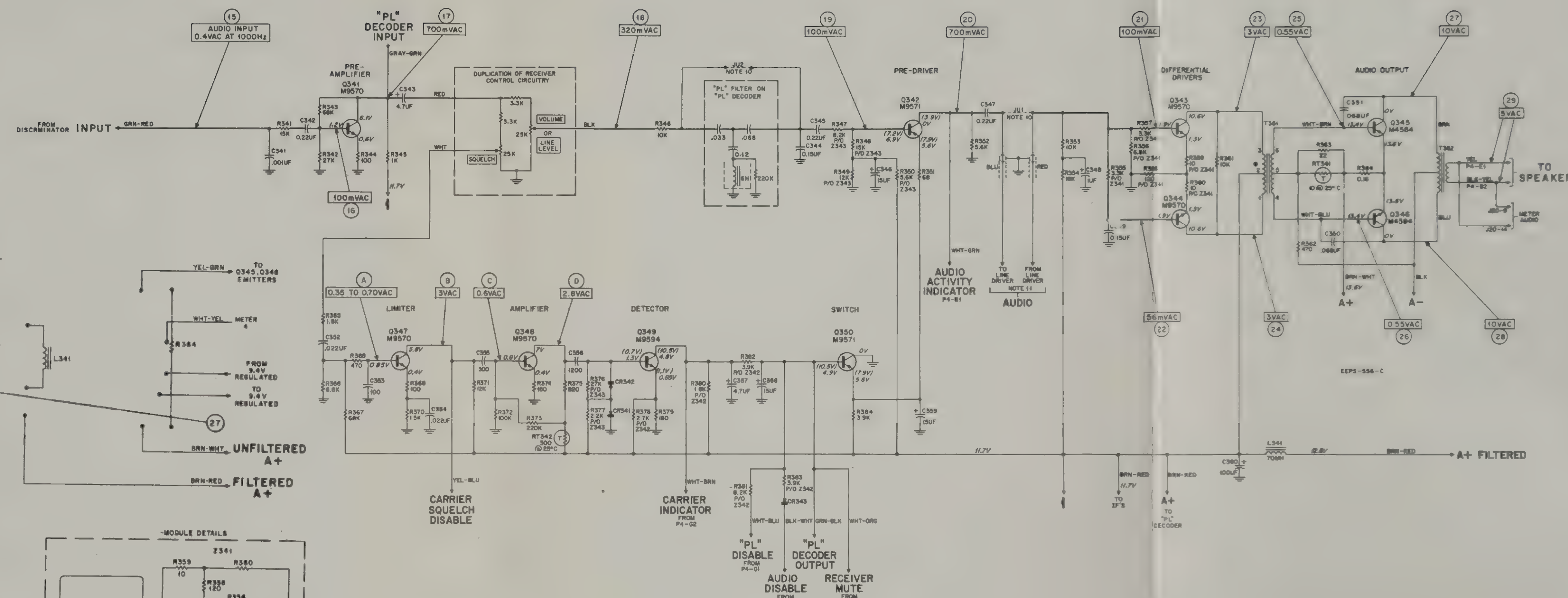
NOTES:

I. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

II. TLN8747AL used in receivers which employ low-side injection in high IF board.

III. CR303 and CR304 are reversed in polarity for Model TLN8747AL.

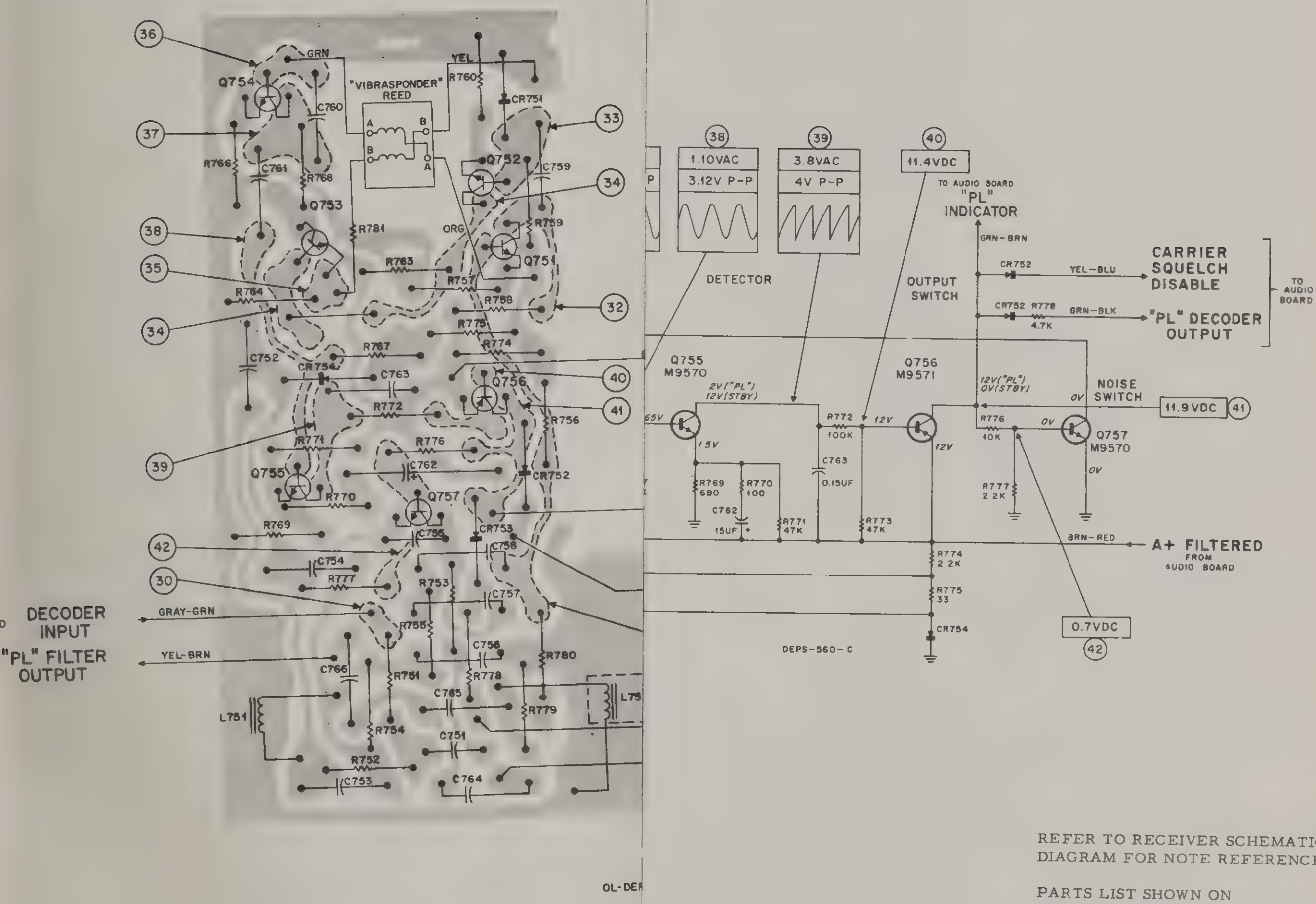




REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8783A-2 Audio and Squelch Circuit Board Detail
Motorola No. PEPS-1793-E
8/23/72- UP



REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

RECEIVER

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

"Private-Line" Decoder and Filter Circuit Board Detail
Motorola No. PEPS-446-C
7/8/71-UP

REVISIONS

PEPS-1793-E

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8783A-1	R362	WAS 6S6291, 560 ±10%; 1/2 W	T352 PRIMARY TAP
TLN8783A-2			

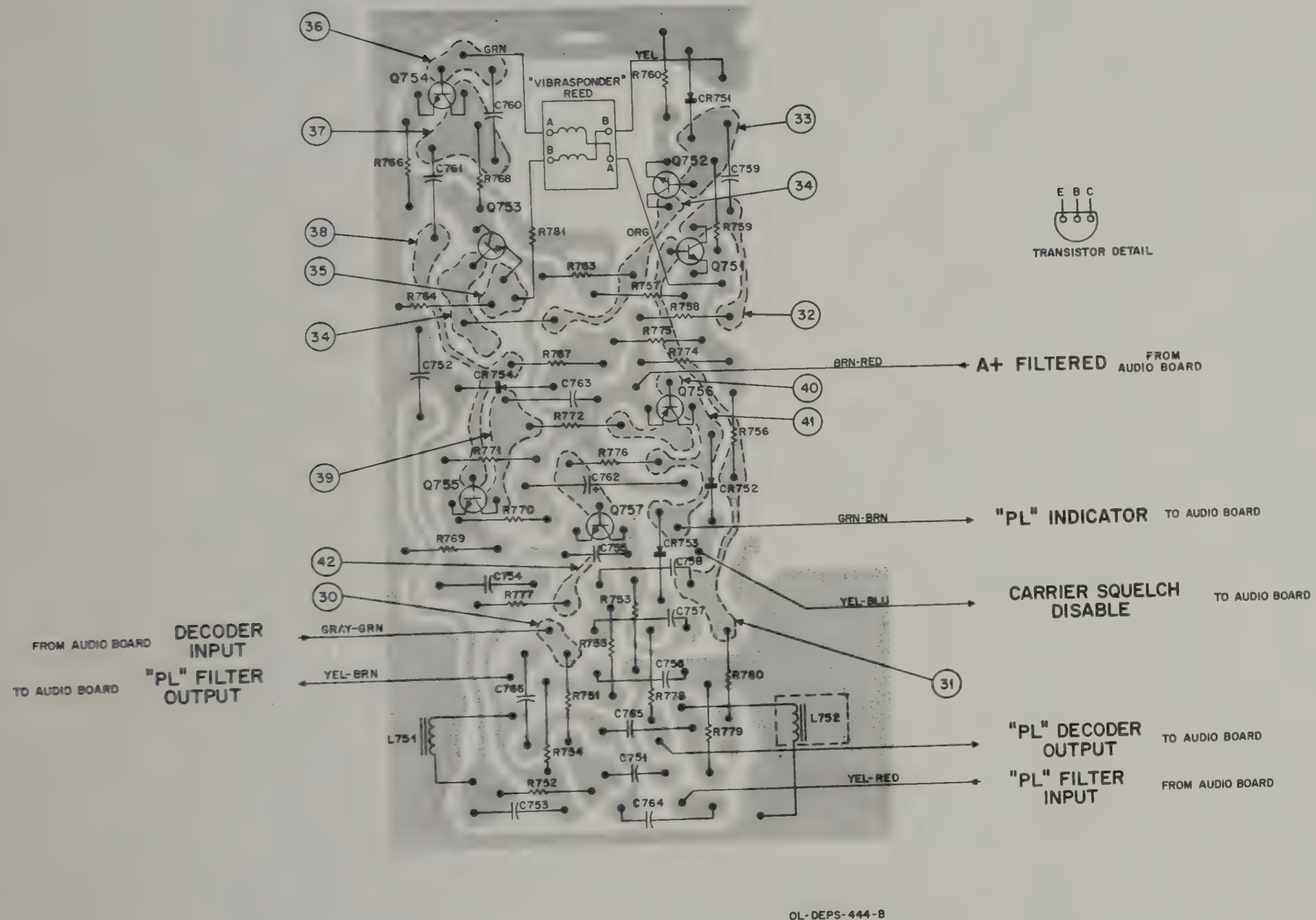
PARTS LIST

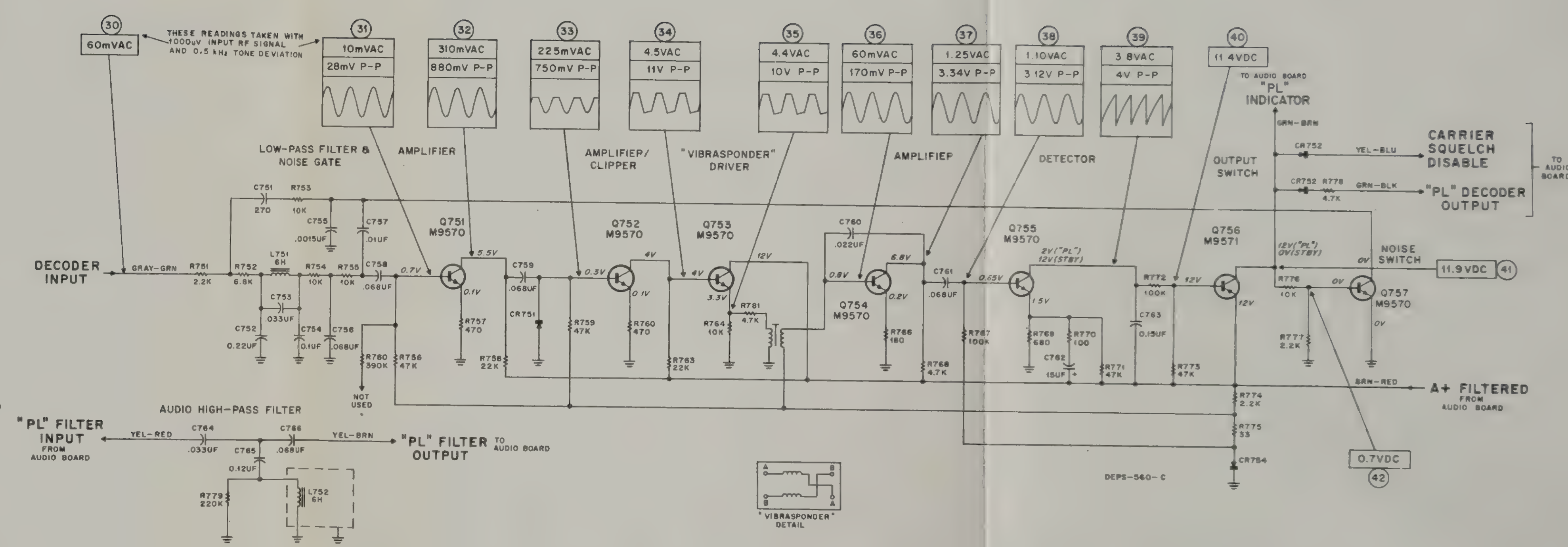
TLN8783A Audio & Squelch Board PL-320-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; ±10%; 50 v; unl. stated
C341	21D82187B29	.001; 100 v
C342, 345, 347	8D82905G11	0.22
C343, 357	23K865137	4.7 ±20%; 25 v
C344, 349	8D82905G05	0.15
C346, 358, 359	23K865136	15 +20%; 25 v
C348	23D82783B08	1 ±20%; 35 v
C350, 351	8D82905G04	.068
C352, 354	8D82905G02	.022
C353	21K850118	100 pF ±5%; 300 v
C355	21K859944	300 pF ±5%; 500 v
C356	21K874352	1200 pF ±5%; 300 v
C360	23D82601A25	100 +150-10%; 20 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR341, 342, 343	48C82392B03	silicon
		COIL, RF:
L341	25B82878A03	choke; 70 mH
		TRANSISTOR: (SEE NOTE)
Q341, 343, 344, 347, 348	48R869570	N-P-N; type M9570
Q342, 350	48R869571	P-N-P; type M9571
Q349	48R869594	N-P-N; type M9594
		RESISTOR, fixed: ±5%; 1/4 w; unl. stated
R341	6S127805	15K ±10%
R342	6S127806	27K ±10%
R343	6S185C02	68K ±10%; 1/8 w
R344, 369	6S131524	100
R345	6S129805	1K
R346	6S185B91	10K ±10%; 1/8 w
R351	6S129861	68 ±10%
R352	6S129433	5.6K ±10%
R353, 361	6S129225	10K ±10%
R354	6S129804	18K ±10%
R362	6S488045	470 ±5%; 1 W
R363	6S131641	22 ±10%
R364	17C82350A05	0.16 ±10%; 1 w
R365	6S185B82	1.8K ±10%; 1/8 w
R366	6S129237	6.8K
R367	6S129299	68K
R368	6S127801	470 ±10%
R370	6S185A53	1.5K; 1/8 w
R371	6S129887	12K
R372	6S124A97	100K
R373	6S185B06	220K; 1/8 w
R374	6S131276	150
R375	6S185A47	820; 1/8 w
R379	6S129431	180
R384	6S129?32	3.9K ±10%
		THERMISTOR:
RT341	6C82769A01	10 ohms @ 25°C
RT342	6B865641	300 ohms @ 25°C
		TRANSFORMER, AF:
T351	25C82058H01	lug terminals (not marked); pri: (center-tapped); total res. 670 ohms max. sec: (center-tapped); total res. 13 ohms max (primary center tap coded WHT dot)
		PACKAGED RESISTOR NETWORK:
Z341	51D82070H06	incl. R355, R356, R357, R358, R359, R360
Z342	51D82070H08	incl. R378, R380, R381, R382, R383
Z343	51D82070H09	incl. R347, R348, R349, R350, R376, R377

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



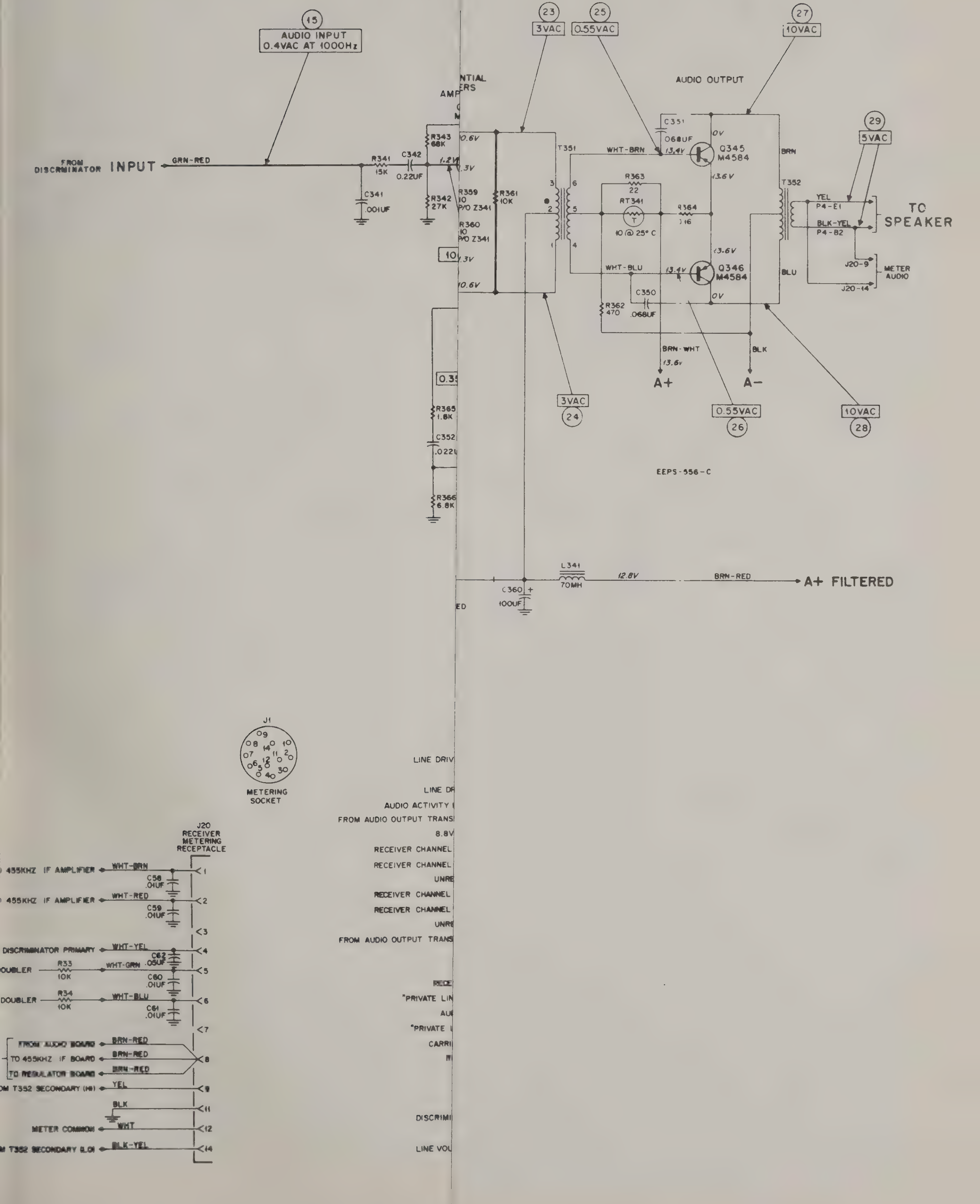


REFER TO RECEIVER SCHEMATIC DIAGRAM FOR NOTE REFERENCES

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

"Private-Line" Decoder and Filter Circuit Board Detail
Motorola No. PEPS-446-C
7/8/71-UP

RECEIVER



AUDIO INPUT 0.4VAC AT 1000Hz
FROM DISCRIMINATOR INPUT
GRN-RED
R341 15K
C342 0.22UF
C341 .001UF
R343 68K
R342 27K
AMP
R359 10 P/O Z341
R360 10 P/O Z341
R361 10K
T351
3VAC
0.55VAC
10VAC
5VAC
AUDIO OUTPUT
C351 .068UF
WHT-BRN
Q345 M4584
Q346 M4584
R363 22
RT341 10 @ 25° C
R364 .16
WHT-BLU
C350 .068UF
R362 470
BRN-WHT
BLK
A+
A−
T352
BRN
BLU
YEL
P4-E1
BLK-YEL
P4-B2
TO SPEAKER
J20-9
J20-14
METER AUDIO
R365 1.8K
C352
R366 6.8K
L341 70MH
12.8V
BRN-RED
A+ FILTERED
C360 100UF
EEPS-556-C
J1
METERING SOCKET
J20 RECEIVER METERING RECEPTACLE
455KHZ IF AMPLIFIER
WHT-BRN
C58 .01UF
WHT-RED
C59 .01UF
DISCRIMINATOR PRIMARY
WHT-YEL
C62 .05UF
R33 10K
WHT-GRN
C60 .01UF
R34 10K
WHT-BLU
C61 .01UF
FROM AUDIO BOARD
TO 455KHZ IF BOARD
TO REGULATOR BOARD
BRN-RED
T352 SECONDARY (HI)
YEL
BLK
METER COMMON
WHT
T352 SECONDARY (LO)
BLK-YEL
LINE DRIV
AUDIO ACTIVITY
FROM AUDIO OUTPUT TRANS
8.8V
RECEIVER CHANNEL
"PRIVATE LIN
CARRI
DISCRIMI
LINE VOL

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

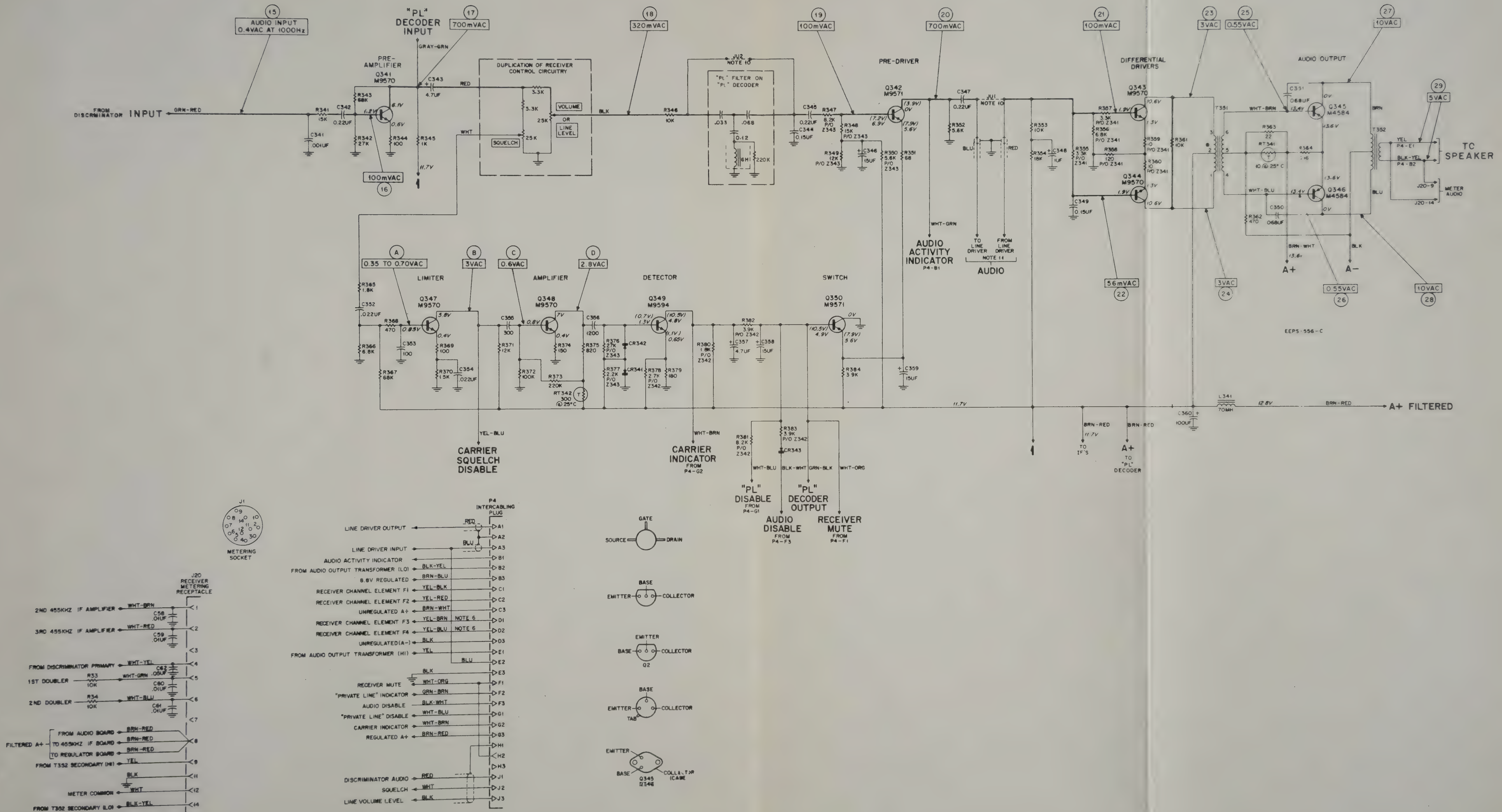
PARTS LIST

TLN8785A "PL" Decoder Board PL-324-A

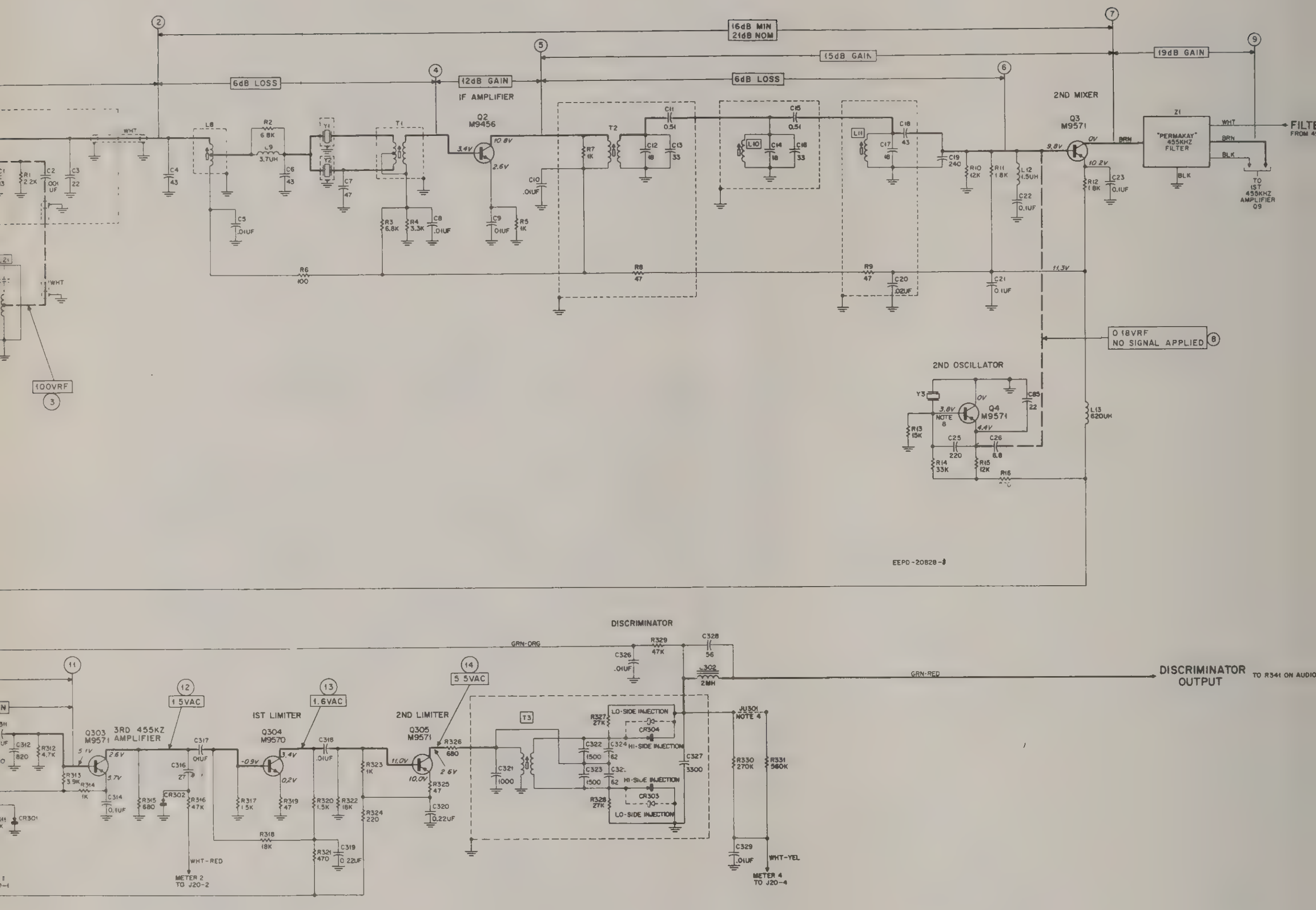
		CAPACITOR, fixed uF; ±10%; 50 v; unl. stated
C751	21D82187B10	270 pF; 500 v
C752	8D82905G11	0.22
C753, 764	8D82905G08	.033
C754	8D82905G07	0.1
C755	21D82187B18	.0015; 100 v
C756, 758, 759, 761, 766	8D82905G04	.068
C757	8D82905G01	.01
C760	8D82905G02	.022
C762	23D83214C02	15 ±20%; 25 v
C763	8D82905G05	0.15
C765	8D82905G09	0.12
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR751, 752, 753, 754	48C82392B03	silicon
		REACTOR: AF choke;
L751	24C84003A01	6 H
L752	24C84004A01	6 H; shielded
		TRANSISTOR: (SEE NOTE)
Q751, 752, 753, 754, 755, 757	48R869570	N-P-N; type M9570
Q756	48R869571	P-N-P; type M9571
		RESISTOR, fixed: ±5%; 1/4 w; unl. stated
R751, 777	6S128689	2.2K ±10%
R752	6S128687	6.8K ±10%
R753, 754, 755, 764, 776	6S129225	10K ±10%
R756, 759, 773	6S131527	47K
R757, 760	6S129709	470
R758, 763	6S129667	22K
R766	6S129431	180
R767, 772	6S124A97	100K
R768, 771 778, 781	6S129669	4.7K
R769	6S129984	680
R770	6S129753	100 ±10%
R774	6S129804	2.2K
R775	6S124A13	33
R779	6S129147	220K ±10%
R780	6S128682	390K ±10%
NON-REFERENCED ITEMS		
	14C83485C01	SOCKET, "Vibrasponder" Resonant Reed; 4 cont.

NOTE:

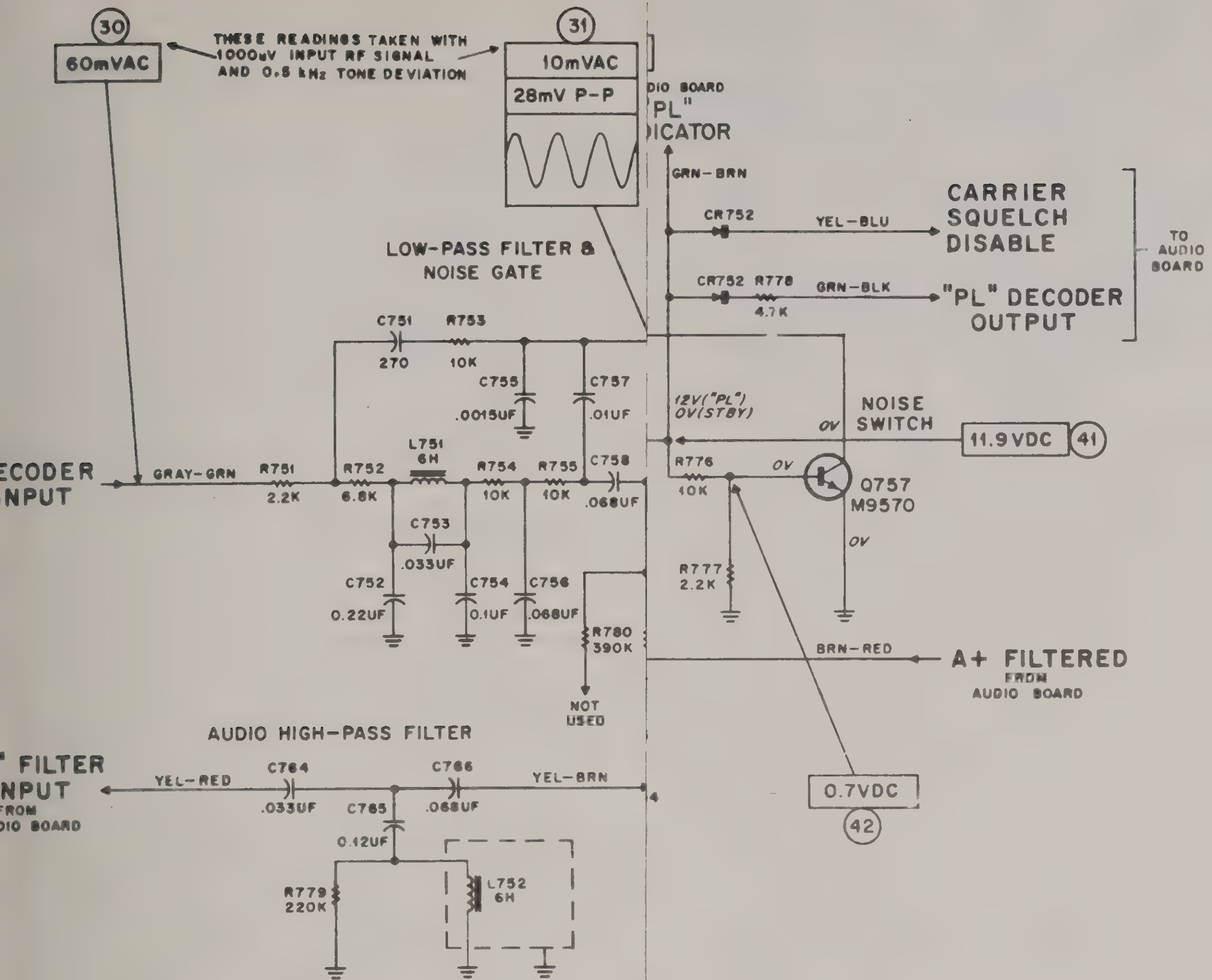
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



AUDIO INPUT 0.4VAC AT 1000Hz
"PL" DECODER INPUT
700mVAC
320mVAC
100mVAC
700mVAC
100mVAC
3VAC
0.55VAC
10VAC
5VAC
FROM DISCRIMINATOR INPUT
PRE-AMPLIFIER
Q341 M9570
DUPLICATION OF RECEIVER CONTROL CIRCUITRY
VOLUME
OR LINE LEVEL
SQUELCH
"PL" FILTER ON "PL" DECODER
PRE-DRIVER
Q342 M9571
DIFFERENTIAL DRIVERS
Q343 M9570
Q344 M9570
AUDIO OUTPUT
Q345 M4584
Q346 M4584
TC SPEAKER
METER AUDIO
100mVAC
AUDIO ACTIVITY INDICATOR
TO LINE DRIVER
FROM LINE DRIVER
AUDIO
56mVAC
3VAC
0.55VAC
10VAC
EEPS-556-C
0.35 TO 0.70VAC
3VAC
0.6VAC
2.8VAC
LIMITER
Q347 M9570
AMPLIFIER
Q348 M9570
DETECTOR
Q349 M9594
SWITCH
Q350 M9571
A+ FILTERED
CARRIER SQUELCH DISABLE
CARRIER INDICATOR
"PL" DISABLE
AUDIO DISABLE
"PL" DECODER OUTPUT
RECEIVER MUTE
TO IF'S
A+ TO "PL" DECODER
METERING SOCKET
J20 RECEIVER METERING RECEPTACLE
2ND 455KHZ IF AMPLIFIER
3RD 455KHZ IF AMPLIFIER
FROM DISCRIMINATOR PRIMARY
1ST DOUBLER
2ND DOUBLER
FILTERED A+
FROM AUDIO BOARD
TO 455KHZ IF BOARD
TO REGULATOR BOARD
FROM T352 SECONDARY (HI)
METER COMMON
FROM T352 SECONDARY (LO)
P4 INTERCABLING PLUG
LINE DRIVER OUTPUT
LINE DRIVER INPUT
AUDIO ACTIVITY INDICATOR
FROM AUDIO OUTPUT TRANSFORMER (LO)
9.6V REGULATED
RECEIVER CHANNEL ELEMENT F1
RECEIVER CHANNEL ELEMENT F2
UNREGULATED A+
RECEIVER CHANNEL ELEMENT F3
RECEIVER CHANNEL ELEMENT F4
UNREGULATED (A-)
FROM AUDIO OUTPUT TRANSFORMER (HI)
RECEIVER MUTE
"PRIVATE LINE" INDICATOR
AUDIO DISABLE
"PRIVATE LINE" DISABLE
CARRIER INDICATOR
REGULATED A+
DISCRIMINATOR AUDIO
SQUELCH
LINE VOLUME LEVEL
GATE
SOURCE
DRAIN
BASE
EMITTER
COLLECTOR
Q2
TAB
Q345 Q346
COLLECTOR (CASE)



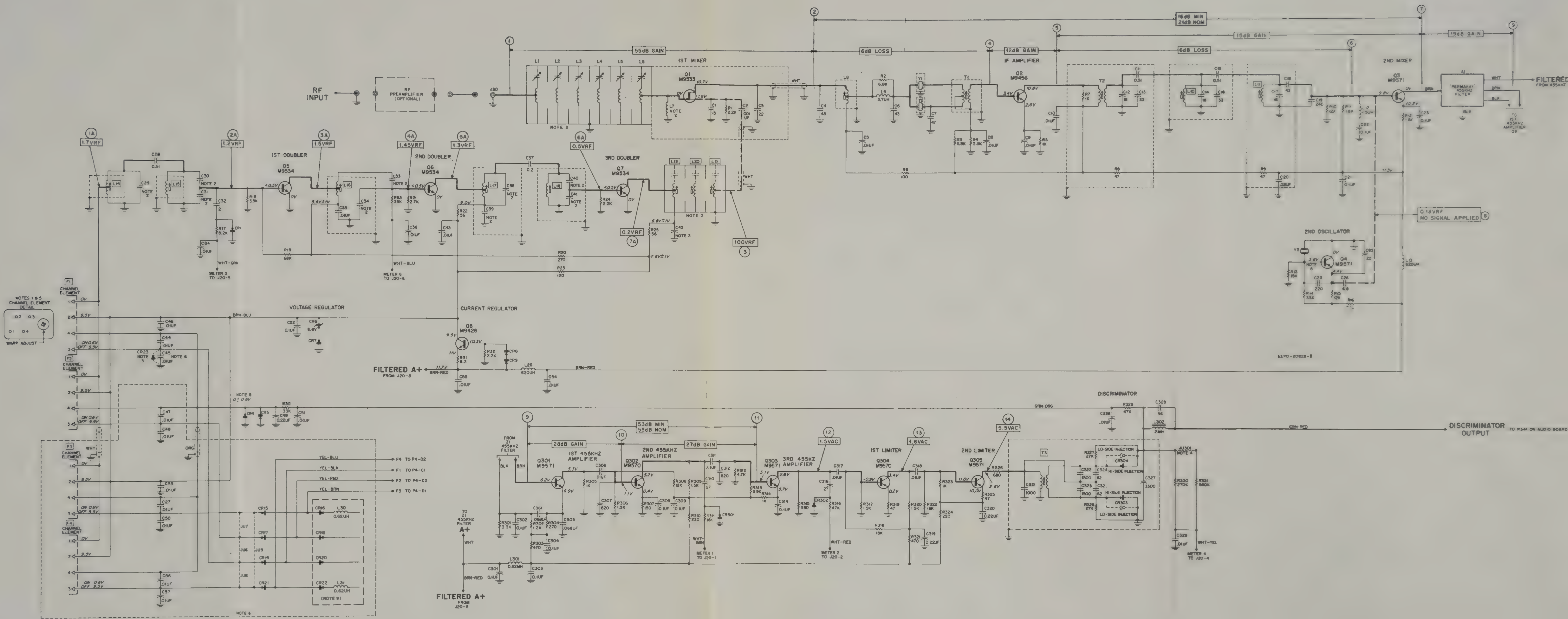
16dB MIN 21dB NOM
15dB GAIN
19dB GAIN
6dB LOSS
12dB GAIN
IF AMPLIFIER
2ND MIXER
Q2 M9456
Q3 M9571
"PERMAKAY" 455KHZ FILTER
FILTER
TO 1ST 455KHZ AMPLIFIER Q9
100VRF
0.18VRF NO SIGNAL APPLIED
2ND OSCILLATOR
Q4 M9571
EEPD-20828-0
DISCRIMINATOR
DISCRIMINATOR OUTPUT
TO R341 ON AUDIO
3RD 455KHZ AMPLIFIER
Q303 M9571
1ST LIMITER
Q304 M9570
2ND LIMITER
Q305 M9571
1.5VAC
1.6VAC
5.5VAC
LO-SIDE INJECTION
HI-SIDE INJECTION
METER 2 TO J20-2
METER 4 TO J20-4



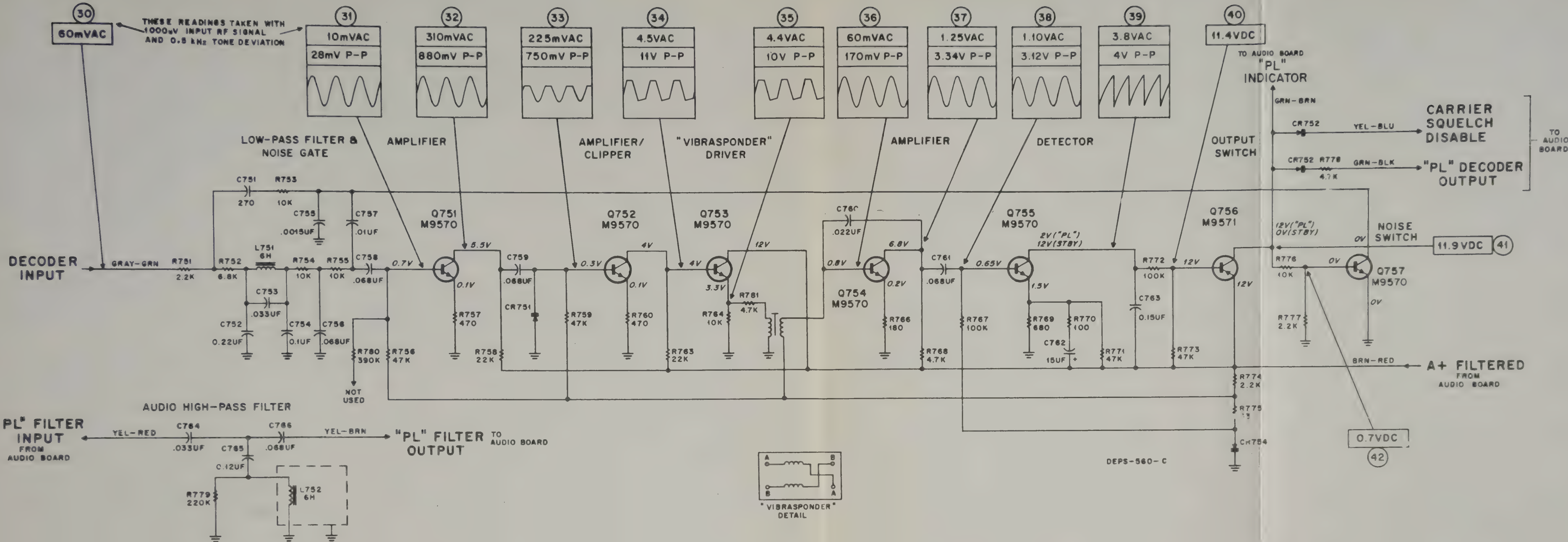
RECEIVER

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Receiver Schematic Diagram
Motorola No. 63P81001E17-K
(Sheet 2 of 2)
8/23/72-UP



Receiver Schematic Diagram
Motorola No. 63P81001E17-K
(Sheet 1 of 2)
8/23/72-UP



NOTES

1. FREQUENCY CALCULATIONS:

$$f_{o1} = \frac{f_c - 11.7\ \text{MHz (or 11.6 MHz in two-receiver stations using shifted i-f)}}{24}$$

IN TWO-RECEIVER BASE STATIONS (WHEN THE CARRIER SEPARATION BETWEEN RECEIVERS IS 5.85 MHz OR 11.7 MHz ±50 kHz), THE LOWER-FREQUENCY RECEIVER USES AN 11.7 MHz IF AND THE HIGHER-FREQUENCY RECEIVER USES AN 11.6 MHz (SHIFTED) IF.

2. SEE PARTS LIST FOR COMPONENT INFORMATION.
3. USED IN 1-FREQUENCY RADIOS ONLY.
4. JUMPER JU301 USED IN ALL MODELS.
5. PIN NUMBERS ARE FOR REFERENCE ONLY.
6. USED IN 4-FREQUENCY MODELS ONLY.
7. ALL DC VOLTAGES ARE MEASURED WITH A 20,000 OHM PER-VOLT MULTIMETER, EXCEPT WHERE OTHERWISE NOTED.
8. USE VACUUM TUBE VOLTMETER.
9. NOT USED.
10. JUMPERS: JU1-REMOVED FOR REMOTE OPERATION. JU2-REMOVED FOR "PL" OPERATION.
11. REFERS ONLY TO REMOTE AUDIO PATH (REMOTE CONTROL STATIONS ONLY).
12. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS; RESISTOR VALUES ARE IN OHMS (K = 1000).
13. COMPONENT REFERENCES OUTLINED BY A RECTANGLE INDICATE MARKINGS ON CHASSIS.
14. DOUBLE VOLTAGE REFERENCE POINTS IN THE AUDIO AND SQUELCH CIRCUIT: PARENTHESES INDICATES VALUE FOR USQ UNSQUELCHED MODE). NO PARENTHESES INDICATES VALUE FOR FSQ (FULL SQUELCH MODE).

EPD-21323-O

RECEIVER

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Receiver Schematic Diagram
Motorola No. 63P81001E17-K
(Sheet 2 of 2)
8/23/72-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

hannel Element PL-313-A

	CER107B	CHANNEL ELEMENT, receiver control: frequency stability ±5 ppm; c/o: TLN8968A OSCILLATOR MODULE, receiver: 406-512 MHz, RES-107A RESONATOR MODULE: incl. quartz crystal NOTE This channel element must be used in the "No. 2 receiver" in two-receiver installations when the incoming carriers have a separation of 5.85 or 11.7 MHz (±50 kHz)

N6373A Cable Kit (1-Freq)
N6374A Cable Kit (4-Freq) PL-316-A

		CONNECTOR, plug c/o: 14C82337A11 BODY 29C82335A01 TERMINAL, contact: male 29C82336A02 TERMINAL, contact: female 15D83934A11 COVER

TE

Replacement transistors must be ordered by Motorola part number only for optimum performance.

RECEIVER ALIGNMENT PROCEDURE

A. TEST EQUIPMENT REQUIRED

Motorola S1056A-9A Series Portable Test Set with a TKN6025A Adapter Cable (available on separate order). A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.

Motorola Model S1318A FM Signal Generator (or equivalent).

Motorola Model TLN6845A Tuning Tool Kit. A small screwdriver may be used for some of the alignment.

Motorola Solid-State DC Multimeter, rf probe, and 50-ohm termination (or equivalent).

B. HOW TO SET UP THE S1056A PORTABLE TEST SET

Set function selector switch to RCVR position.

Switch on 455 kHz crystal oscillator.

Connect 20-pin meter cable plug to test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.

Connect the rf extension cable to the test set; connect the rf probe cable to the rf extension cable.

C. HOW TO SET UP THE SIGNAL GENERATOR FOR RF ALIGNMENT

Set up the signal generator according to the instructions supplied with the unit.

Connect the signal generator cable to the antenna input.

Turn the generator output up to maximum.

Keep the test set in position 4.

Rotate the signal generator dial back and forth near the assigned rf carrier frequency. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated. If no indication can be obtained, place the center conductor of the generator cable at the top of L8 on the 11.7 MHz i-f board. Set the dial for exact zero reading. Be sure the generator frequency is kept at zero meter reading.

D. FREQUENCY CALCULATIONS

For all One-Receiver Stations and most Two-Receiver Stations

$$f_1 = \frac{f_c - 11.7\ \text{MHz}}{24}$$

f_2 = 12.155 MHz (11.245 MHz is factory selected for some units)

WHERE

f_1 = channel element frequency

f_c carrier frequency

f_2 = second oscillator frequency

REVISIONS

63P81001E17-K

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
TLN8747A-1 TLN8747AL-1				455 kHz IF BD. PEPS-1167-A
TLN8747A-2 TLN8747AL-2		EXTENSIVE CIRCUIT CHANGES		455 kHz IF BD. PEPS-3325-O
TLN8752A-1 TLN8752AL-1 TLN8753A-1 TLN8753AL-1				1ST IF & 2ND OSC. BD. PEPS-1293-A
TLE6362A-1				RF DECK PEPS-1162-C
TLN8783A-2				AUDIO & SQUELCH BD. PEPS-1793-C
TLN8748A-1 TLN8749A-1				MULTIPLIER BD. PEPS-1783-C
TLN8846A	C62	ADDED .05 uF	J1-4	NONE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

PARTS LISTS FOR PRINTED CIRCUIT BOARDS ARE ON THE BACK OF THE CORRESPONDING PRINTED CIRCUIT BOARD DETAILS

RECEIVER

TLN8846A Metering Socket & Cable PL-315-A

		CAPACITOR, fixed
C58, 59, 60, 61	21K832501	.01 uF +60-40%; 250 v
C62	21C82372C07	.05 uF +80-20%; 25 v
		CONNECTOR, receptacle
J1	9C857358	female; 12 cont.
		RESISTOR, fixed
R33, 34	6S129225	10K ±10%; 1/4 w

IF Filter PL-314-O

Z1	TFN6022AS	FILTER, IF bandpass: (split channel); center freq. 455 kHz

TLN8993A Receiver Chassis Kit (Carrier Squelch)
TLN8994A Receiver Chassis Kit (Tone-Coded Squelch)
PL-317-O

		TRANSISTOR:
Q345, 346	48K134584	P-N-P; type M4584; does not incl. 14B82399B01 INSULATOR, mtg
		TRANSFORMER, AF
T352	25C82061H02	lug terminals (not marked) pri: center tapped; total res 0.5 ohms ±10% sec: res 0.2 ohms max.
		SOCKET, transistor:
XQ345, 346	9B851303	2 cont

Channel Element (Receiver) PL-349-O

	CER-106A	receiver control: ±.0005% freq. stability incl. TLN8967A OSCILLATOR; receiver RES-106A RESONATOR, receiver

Channel Element (Receiver with AFC) PL-423-O

	CER-106B	CHANNEL ELEMENT, receiver control: capable of ±.0002% frequency stability in receivers with AFC; consists of: TLN8968A Oscillator Module RES-106B Resonator Module (crystal)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

Channel Element PL-313-A

	CER107B	CHANNEL ELEMENT, receiver control: frequency stability ±5 ppm; c/o: TLN8968A OSCILLATOR MODULE, receiver: 406-512 MHz, RES-107A RESONATOR MODULE: incl. quartz crystal NOTE This channel element must be used in the "No. 2 receiver" in two-receiver installations when the incoming carriers have a separation of 5.85 or 11.7 MHz (±50 kHz)

TKN6373A Cable Kit (1-Freq)
TKN6374A Cable Kit (4-Freq) PL-316-A

P4		CONNECTOR, plug c/o: 14C82337A11 BODY 29C82335A01 TERMINAL, contact: male 29C82336A02 TERMINAL, contact: female 15D83934A11 COVER

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.

RECEIVER ALIGNMENT PROCEDURE

A. TEST EQUIPMENT REQUIRED

Motorola S1056A-9A Series Portable Test Set with a TKN6025A Adapter Cable (available on separate order). A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.
Motorola Model S1318A FM Signal Generator (or equivalent).
Motorola Model TLN6845A Tuning Tool Kit. A small screwdriver may be used for some of the alignment.
Motorola Solid-State DC Multimeter, rf probe, and 50-ohm termination (or equivalent).

B. HOW TO SET UP THE S1056A PORTABLE TEST SET

Set function selector switch to RCVR position.
Switch on 455 kHz crystal oscillator.
Connect 20-pin meter cable plug to test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.
Connect the rf extension cable to the test set; connect the rf probe cable to the rf extension cable.

C. HOW TO SET UP THE SIGNAL GENERATOR FOR RF ALIGNMENT

Set up the signal generator according to the instructions supplied with the unit.
Connect the signal generator cable to the antenna input.
Turn the generator output up to maximum.
Keep the test set in position 4.
Rotate the signal generator dial back and forth near the assigned rf carrier frequency. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated. If no indication can be obtained, place the center conductor of the generator cable at the top of L8 on the 11.7 MHz i-f board. Set the dial for exact zero reading. Be sure the generator frequency is kept at zero meter reading.

D. FREQUENCY CALCULATIONS

For all One-Receiver Stations and most Two-Receiver Stations

$$f_1 = \frac{f_c - 11.7\text{ MHz}}{24}$$

f_2 = 12.155 MHz (11.245 MHz is factory selected for some units)

WHERE

f_1 = channel element frequency

f_c = carrier frequency

f_2 = second oscillator frequency

For Receiver on Highest Frequency in Two-Receiver Stations where carrier frequencies are separated by 5.85 MHz ±50 kHz or 11.7 MHz ±50 kHz

$$f_1 = \frac{f_c - 11.6\ \text{MHz}}{24}$$

f_2 = 12.055 MHz (11.145 MHz is factory selected for some units)

WHERE:

f_1 = channel element frequency

f_c = carrier frequency

f_2 = second oscillator frequency

E. TEST SET SELECTOR SWITCH POSITIONS

S1056A-9A TEST SETS	1	2	4	5	6	11
CIRCUIT METERED	455 kHz IF Ampl. #2	455 kHz IF Ampl. #3	Discrim.	1st Osc.	Multiplier	Audio Output
TYPICAL NO SIGNAL READING WITH RECEIVER ALIGNED	8 uA or more (with preamp) 2 uA or more (without preamp)	26 uA	±2 uA	20 uA	13 uA	---

F. RECEIVER ALIGNMENT

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
1	T3	1 and 4	DISCRIMINATOR - Set up the test set as described in paragraph B. Adjust T3 so that the slug is close to the center of the coil. Insert a 2 pF capacitor in series with the rf probe. Place the probe on the base of the second mixer (POINT 1). Use a signal input to produce an indication on meter position 1, between 5 uA and 15 uA. Adjust T3 for an absolute zero on the "0" center (top) scale with the switch in position 4. Use screwdriver end of tuning tool A. This is a critical adjustment and should be exactly on zero. Remove the rf probe.
2	L14, L15, L16, L17, L18, L19, L20, L21	5, 6 and 1	MULTIPLIER - On multi-frequency models place the frequency selector switch in the F1 position. Use a small hex-end of tuning tool B. Adjust all coils so that the slugs are very close to the top of the coil (i. e., near the board). Adjust coils L15 and L14 (in that order) for maximum indication on meter position 5. Repeak coils L15 and L14. Adjust L16 for maximum indication on meter position 6. Adjust coils L17 and L18 for a minimum indication on meter 6. Adjust L19 for a small peak indication on meter position 6. Set up the signal generator as described in paragraph C. Apply as much signal as is required at the carrier frequency for an indication of 5 uA on meter position 1. Align coils L21, L20, L19, L18 and L17 (in that order) for maximum indication on meter position 1.

F. RECEIVER ALIGNMENT (CONT'D)

ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
C1, C2	1	RF PREAMPLIFIER - Adjust C2 and C1 in that order on the rf preamplifier for maximum meter indication in position 1. Use screwdriver end of tuning tool B.
L1 thru L6	1	RF DECK - Use a screwdriver and preset L1 through L6 by turning the tuning screws counterclockwise (away from the top plate) until the screws are approximately 1/2 inch above the top plate (3.8 inch for frequencies below 460 MHz). Increase the output of the signal generator until an indication of 5 uA is observed on meter position 1. Tune L1 through L6 (in that order) for maximum indication on meter position 1. (Decrease the signal generator output level back to an indication of 5 uA on meter position 1 each time the current rises to 15 uA.) Repeak L1 through L6.
L8, T1 T2, L10, L11	1 and 4	11.7 MHz IF - Readjust carrier frequency for an exact zero reading on meter position 4. Use a signal input of approximately 15 uA on meter position 1. Use large hex end of tuning tool B. Detune L8 and T1 by turning slugs counterclockwise to the top of coil forms (i.e., near the board). Tune L11, L10 and T2 (in that order) for a maximum indication on meter position 1. Repeak L11, L10 and T2. (Do not attempt to repeak these coils during the subsequent adjustments.) Peak L8 and T1 (in that order) for maximum indication on meter position 1. Repeak L8 and T1 two more times. NOTE It is very important that L8 be tuned before T1. Tune by maximum meter indication, not by audio noise.
L1 thru L6, L21	1 and 6	Detune L16 approximately 5 uA on meter position 1. Tune L17, L18, L19, L20 and L21 for a maximum indication on meter position 1. Retune L16 for peak on meter position 6. Repeak L1 thru L1 (in that order) for maximum indication on meter position 1. Repeat. Reduce generator output to 20 dB quieting level. Retune L6 and L21 for best quieting.
C1, C2	1 and 11	RF PREAMPLIFIER - Increase the signal generator output for a small indication in meter position 1 (5-10 uA). Repeak C2 for maximum meter indication in meter position 1. Reduce the signal generator output to the 20 dB quieting level and retouch C1 and L1 for best quieting sensitivity.
F1, F2, F3, F4	1, 2, 4	ON-FREQUENCY ADJUSTMENT - Transmit a carrier from the transmitter which the receiver is normally intended to receive. Test set position 1 should indicate a rise when the transmitter is keyed. If necessary, connect the antenna to the radio set. Check the meter reading in test set position 4. Disable the AFC by shorting the AFC test point to the shield. Zero indicates an on-frequency condition. Set the F1 "warping" capacitor for exact zero meter reading in position 4 on the F1 frequency. On multiple frequency models, set the additional warp capacitors for a zero meter reading on each position of the frequency selector switch. Remove the short from the AFC test point. DO NOT READJUST COILS L14 AND L15

is step unless the radio set is equipped with an optional RF Preamplifier.

G. TWO-RECEIVER STATIONS TUNING INSTRUCTIONS

20 DB QUIETING SENSITIVITY WITHOUT RF PREAMPLIFIER	20 DB QUIETING SENSITIVITY WITH RF PREAMPLIFIER	TWO-RECEIVER FREQUENCY SEPARATION
1.0 uV	0.5 uV	Up to 3 MHz
0.7 uV	0.35 uV	3 MHz - 5 MHz
0.62 uV	---	5 MHz and greater
---	0.31 uV	5 MHz - 10 MHz

WITHOUT RF PREAMPLIFIER

1. Tune each receiver individually with the antenna coupler disconnected.
2. Insert the coupler between the two preselectors.
3. Measure the 20 dB quieting for each receiver. If the sensitivity does not compare with that in th preceding table, slight retuning of preselector input coil (L1) should be all that is required.

For stations which do not meet the 20 dB quieting sensitivity, monitor the receiver with the poorest sensitivity. While monitoring, tune the preselector input coil (L1) of the receiver. If the receiver being monitoried is on a higher frequency than the receiver being tuned, the coil (L1) should be turned inward until the sensitivity improves to that of the preceding chart. Then recheck the sensitivity of the other receiver; if on a lower frequency the coil is turned outward. After the worse case degradation is within specification, remeasure the other unit.

WITH RF PREAMPLIFIER

Up to 5 MHz Receiver Frequency Separation

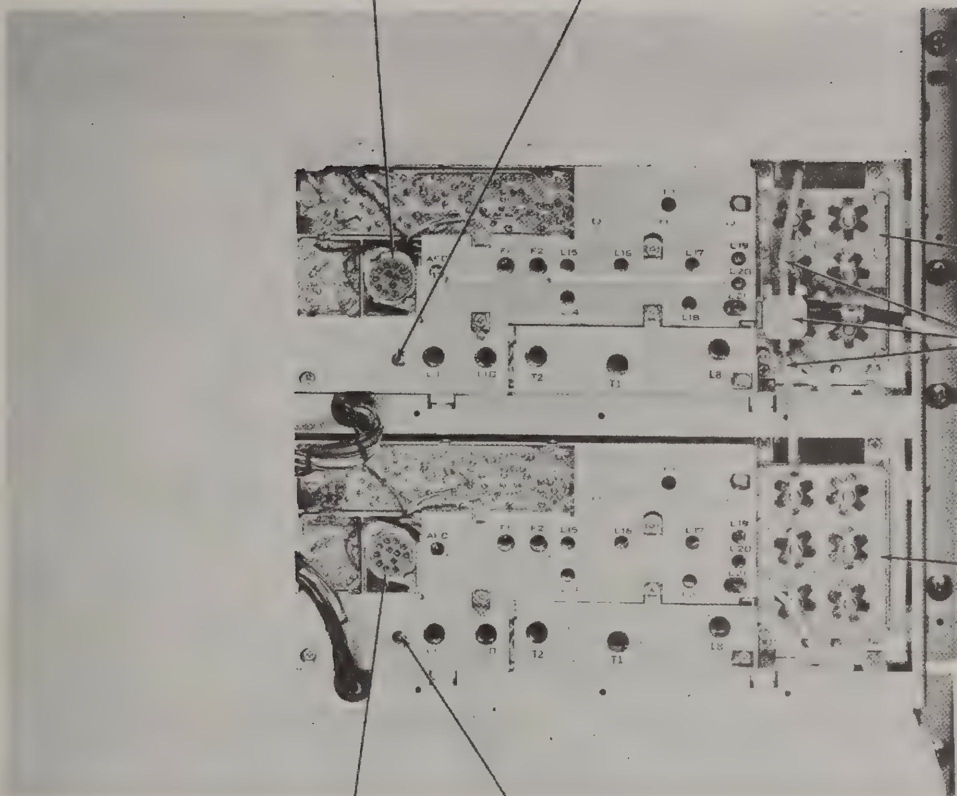
1. Tune each receiver individually with the antenna coupler and rf preamplifier disconnected. Follow the previously detailed single-receiver alignment procedure without an rf preamplifier.
2. Insert the antenna coupler and rf preamplifier between the two receiver preselectors.
3. Adjust C2 and C1, in that order. on the preamplifier for maximum meter indication in position 1 on the higher frequency receiver. Repeat.
4. Perform step 3 in paragraph G -- TWO-RECEIVER STATIONS TUNING INSTRUCTIONS WITHOU RF PREAMPLIFIER -- to complete the alignment procedure.

5 to 10 MHz Receiver Frequency Separation

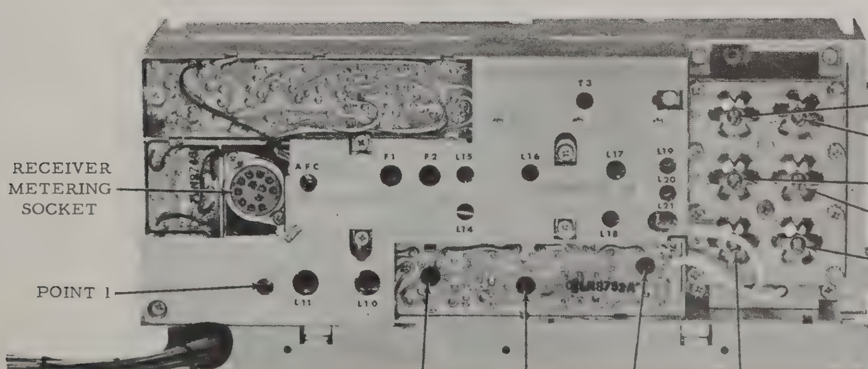
1. Tune each receiver individually with the antenna coupler and rf preamplifier disconnected. Follow the previously detailed single-receiver alignment procedure without an rf preamplifier.
2. Tune the rf preamplifier to a frequency midway between the frequencies of the two receivers while disconnected from the antenna coupler.
   (a) Connect the rf voltmeter through a 50-ohm termination to the OUTPUT of the rf preamplifier
   (b) Connect the rf signal generator to the INPUT of the rf preamplifier and set to a frequency midway between the frequencies of the two receivers.
   (c) Adjust C2 and C1, in that order, on the preamplifier for a maximum meter indication on the rf voltmeter. Repeat.
   (d) Disconnect the test equipment from the rf preamplifier.
3. Connect the rf preamplifier and antenna coupler to the receivers.
4. Perform step 3 in paragraph G -- TWO-RECEIVER STATIONS TUNING INSTRUCTIONS WITHOU RF PREAMPLIFIER -- to complete the alignment procedure.

Greater than 10 MHz Receiver Frequency Separation

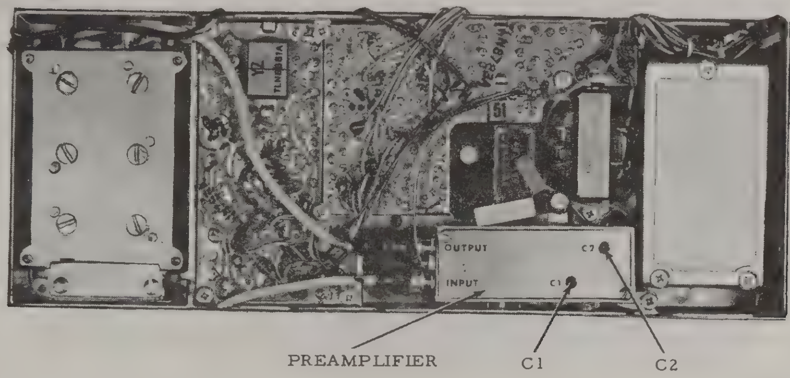
Use of an rf preamplifier is not recommended for receiver frequency separations greater than 10 MHz.



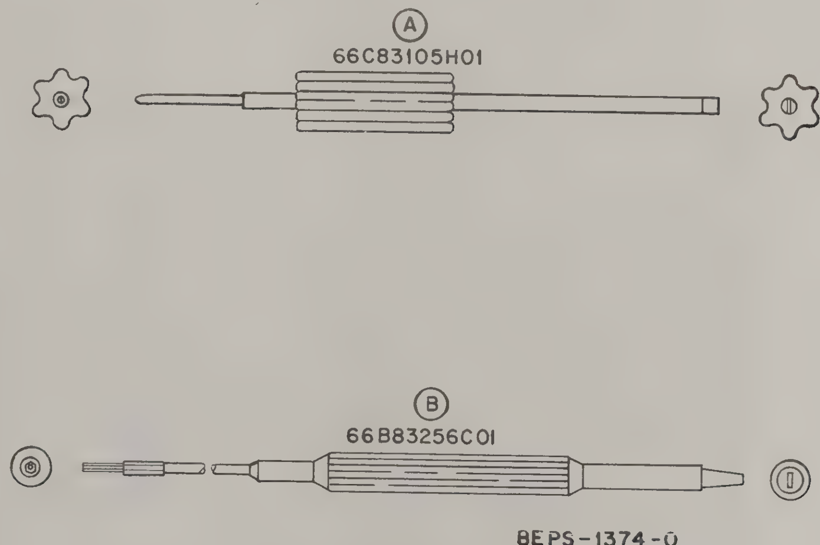
Two Receiver Station Tuning Adjustment Locations



Single Receiver Station Tuning Adjustment Locations



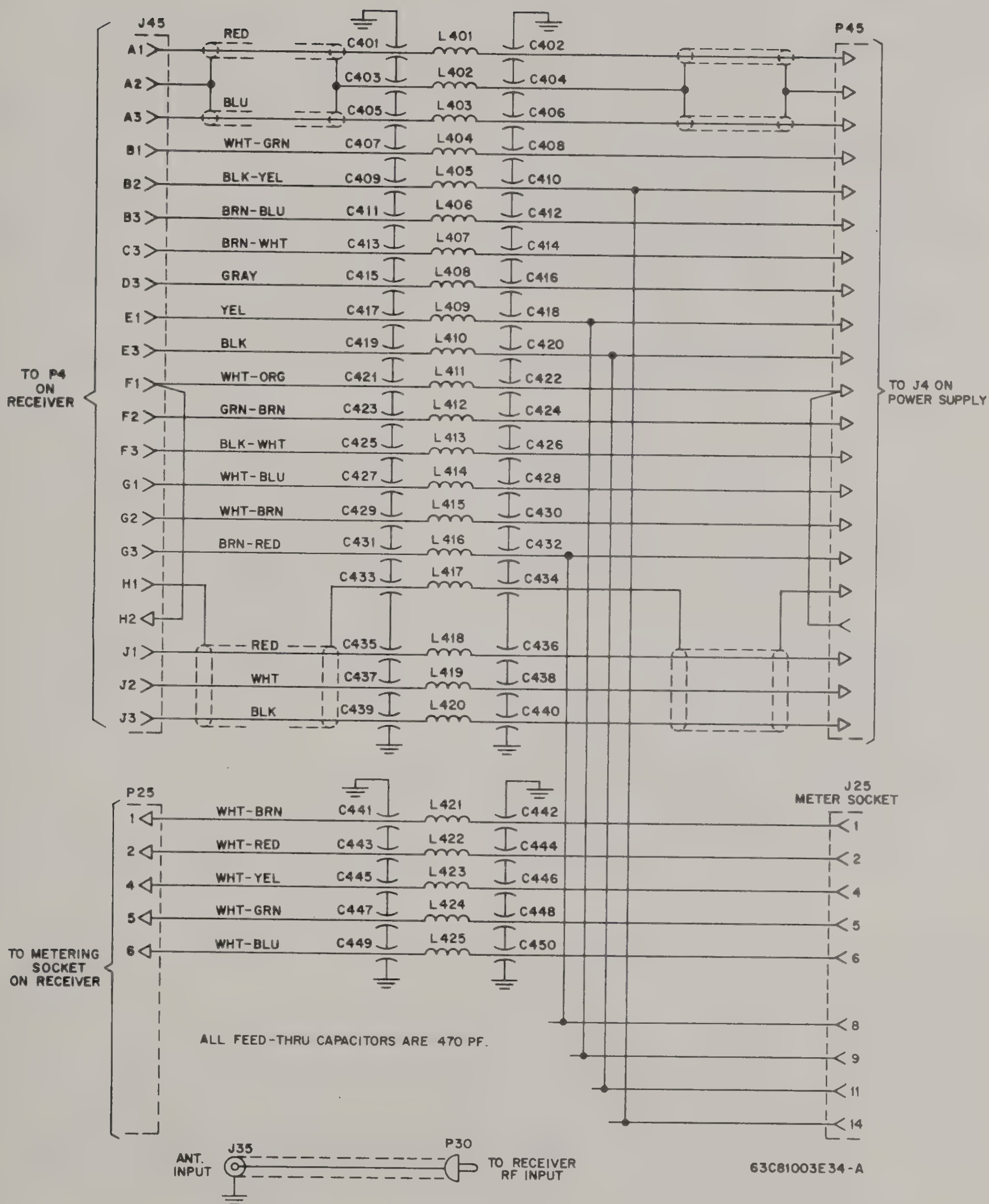
Receiver RF Preamplifier Location



Receiver Tuning Tools

RECEIVER SHIELD KIT

MODEL TLN8889A



PARTS LIST SHOWN ON BACK

RECEIVER SHIELD KIT

MOTOROLA INC.
ENGINEERING PUBLICATIONS
1301 E. ALGONQUIN ROAD
Communications Division
SCHAUMBURG, ILLINOIS 60172

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN8889A Receiver Shield Kit PL-407-B

		CAPACITOR, fixed:
C401 thru 450	21K821474	470 pF
		COIL, rf: choke;
L401 thru 404, 411 thru 415, 417 thru 425	24A890687	2 uH
L405, 406, 407, 408, 409, 410, 416	24K858989	0. 176 uH
		CONNECTOR, receptacle:
J25	9C83478E01	female; 12 contact
J35	9C82323G01	female; single contact
J45		c/o: 14C83783A08 INSULATOR, conn: 29C82336A01 TERMINAL, wire: female; 18 req'd 29C82336A02 TERMINAL, wire: female; 12 req'd 29C82335A02 TERMINAL, wire: male; 1 req'd
		CONNECTOR, plug:
P25	28B864669	male; 12 contact; does not incl. 15A82798H01 SHELL, conn. and 37K10559 GROMMET, rubber:
P30	28B82331G01	male; single contact
P45		c/o: 14C82337A11 INSULATOR, connector: 29C82335A01 TERMINAL, wire: male; 12 req'd 29C82335A02 TERMINAL, wire: male; 9 req'd, 29C82336A02 TERMINAL, wire: female; 1 req'd, 15D83934A11 COVER, connector, 37K103664 GROMMET rubber
NON-REFERENCED ITEMS		
	1V80783A31	CABLE AND PLUG ASSY: incl. ref part P30
	1V80783A34	CONNECTOR AND BRACKET ASSY: incl. ref part J35
	15C83089H01	SHIELD, front
	15C83090H01	SHIELD, rear
	38K890353	BUTTON, plug: 1/2"
	15C83094H01	COVER, filter

POWER SUPPLY

MODEL TPN1089A
(FORMERLY MODELS TPN1061AA-SP4 & TPN1061AC-SP10)
AND "PRIVATE-LINE" TONE OSCILLATOR
MODEL TLN8847A

1. DESCRIPTION

The power supply provides low-voltage power for operating the exciter-transmitter, receiver, power amplifier, and remote control chassis described in this manual. This unit also supplies power for all associated accessories, and filament power for the 8072 tube in the power amplifier.

The power supply comprises one large chassis located centrally within the station cabinet to facilitate interconnections to all of the units requiring low-voltage dc power. Connector cables from the exciter-transmitter, power amplifier, receiver, and control unit all plug into the power supply chassis.

The output voltage of the power supply is extremely well regulated. Current limiting and overvoltage protection are provided for the output. In addition, a separate current-limiting protection circuit for the pre-driver, driver, and final amplifier stages of the exciter-transmitter is included on the power supply chassis.

An electronic filter provides a well-filtered output voltage for the low-power stages of the transmitter and receiver. This voltage is free of any spurious pulses, spikes, or ripple which might appear in the A+ output.

2. BASIC CIRCUITS

a. General UJT Data

The unijunction transistor (UJT) is a special type of transistor used in pulse generators, triggering circuits and other uses where a pulse must be generated repeatedly at a predictable instant of time. The UJT is comprised of two bases (known as "base 1" and "base 2") and an emitter. It has a high input impedance and a stable "firing" (emitter) voltage which is a fixed percentage of the dc "interbase" voltage applied to the circuit. The input circuit of the UJT is between the emitter and "base 1". When the emitter voltage reaches a certain fraction of the interbase voltage, the UJT "fires", providing a pulse of current to the base 1 circuit. The typical output is a positive pulse, developed at base 1.

b. UJT Circuit Operation

As shown in Figure 1, the input dc voltage charges capacitor C1 through resistor R1. When the C1 voltage reaches a precise value (the firing point), the emitter-to-base-1 junction becomes forward biased and conducts.

Capacitor C1 discharges rapidly through the base-1-to-emitter junction, which has a strong negative-resistance characteristic (junction resistance decreases sharply as the current through it increases). The negative-resistance characteristic facilitates the discharge of C1, which continues until the voltage across the junction is no longer sufficient to keep it forward-biased. At this point, the UJT turns off and current flow ceases in the base 1 circuit.

With the base-1-to-emitter junction cut off, the junction once again acts like an open circuit, allowing C1 to start charging up again through R1. When the voltage across C1 reaches the firing point, the UJT fires and another current pulse flows in the output circuit. The process continues as long as the dc voltage is applied to the UJT circuit, developing a continuous train of output pulses from the UJT.

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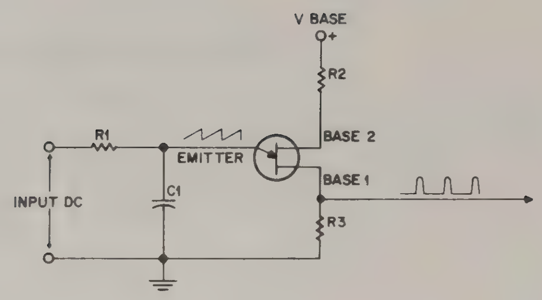


BEPS-1379-0

Figure 1.
Typical UJT Pulse Generator

3. CIRCUIT OPERATION

(Refer to Figure 2, Power Supply Block Diagram, and to the Power Supply Schematic Diagram.)

a. General

This solid-state power supply consists of a silicon-controlled rectifier (SCR) pre-regulator, which is controlled by a unijunction transisto (UJT) triggering circuit. The pre-regulator feeds a series regulator whose output powers all the high-current, low-voltage circuits. An electroni filter removes variations in the output of the series regulator and feeds the low levels of the receive and transmitter.

b. Pre-Regulator

When 120 volts ac is applied to the primary of T1, the voltage from the secondary is applied to the pre-regulator bridge circuit. The pre-regulator uses a pair of diodes (CR1 and CR2) and a pair of SCR's (SCR1 and SCR2) in a bridge configuration to feed an LC filter (L1 and C2). The output of this filter is sampled and fed back through a phase-shift network (L2 and C11) to a unijunction transistor (UJT) trigger circuit. The UJT trigger circuit incorporates its own constant voltage source and a line-synchronized interbase voltage for the UJT (Q8).

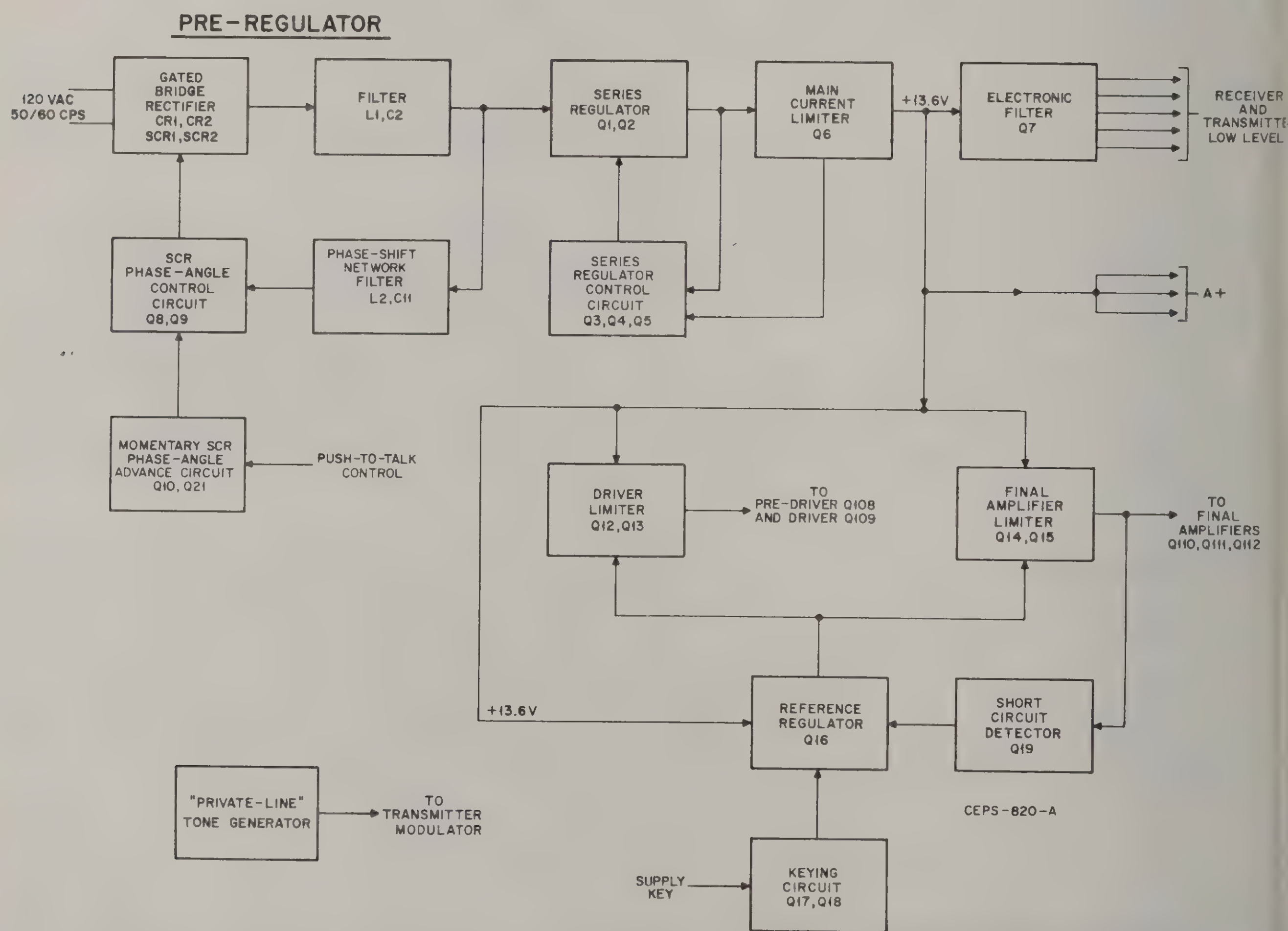


Figure 2.
Power Supply Block Diagram

c. UJT Trigger Circuit

The UJT trigger circuit adjusts the firing angle of the bridge SCR's, thereby keeping the output of filter L1-C2 at a relatively constant dc level. Full-wave rectifier CR3, CR4 at the secondary of T1 supplies the voltage for the UJT control circuit. The full-wave rectified voltage (waveform C on schematic diagram) is supplied to a peak rectifier circuit (CR12 and C10) and clamped by a Zener diode (CR14). The constant 16 volts across CR14 is applied to the charging network (R21, C8) in the UJT emitter circuit. At the same time, a portion of the full-wave rectified voltage is clamped by Zener diode CR13 to supply a line-synchronized interbase voltage to UJT Q8. (See waveform D on schematic diagram.) With these voltages applied to Q8, the unijunction transistor fires and supplies pulses of current to the base of transistor Q20 at regular intervals. The pulses occur at twice the frequency of the ac line voltage due to the full-wave rectifying action of CR3 and CR4.

The primary of pulse transformer T2 is in series with the collector of amplifier Q20. When UJT Q8 fires current into the base of Q20, its collector current pulse is coupled to the secondary of the pulse transformer and applied to the gates of the SCR's through isolating resistors R1 and R4.

Depending on which SCR has the positive anode voltage at that instant, either SCR1 or SCR2 is triggered into conduction. Diode CR6 supplies current continuity when the voltage across L1 changes polarity, thereby allowing SCR1 and SCR2 to shut off.

The voltage at C2 is phase-shifted by L2 and C11 and divided down to the base of Q9. As the voltage across C2 increases, the voltage at the base of Q9 also increases. As a consequence, the collector voltage of Q9 is lowered and the Q8 emitter charging circuit is charged at a slower rate. By charging C8 at a slower rate through R21, Q8 is fired at a later time in each cycle, thereby delaying the firing of SCR1 and SCR2. The result is lower voltage across C2.

Conversely, if the voltage at C2 decreases, the voltage at the base of Q9 also decreases, resulting in a higher Q9 collector voltage. This, in turn, charges C8 at a faster rate, firing Q8 earlier. SCR1 and SCR2 are correspondingly fired sooner in each cycle, causing an increase in the voltage across C2.

The dc voltage across C2 is set by adjusting the arm of "regulator input" potentiometer R29.

The "closed loop" operation as described previously is slow to respond to sudden load variations. This is due to the long time constants of the loop. Additional circuitry is therefore used to advance the firing angles of the SCR's just before a heavy load is applied, i.e., when the station is keyed.

During standby conditions, a positive voltage on the keying line from the control unit is applied via R68 to the base of Q10. Transistor Q10 is in saturation and the collector is close to ground potential. When the station is keyed, Q10 is turned off and a pulse through capacitor C13 pulses Q21 "on", which removes some of the charge from C11. This in turn, lowers the base voltage of Q9. The collector voltage of Q9 increases, thereby charging C8 faster and advancing the firing angle of SCR1 and SCR2. As a consequence, more energy is supplied to filter L1-C2, and a heavy load can then be applied to the output without any appreciable decrease in output voltage.

When a heavy load is applied and held (steady-state conditions), the long time-constant system adjusts the firing angles of the SCR's.

d. Series Regulator

(1) Description

Transistor Q5 is a high-impedance current source, supplying base drive to Q3 in the series regulator. Q3 is the driver transistor for series regulators Q1 and Q2, which are connected in parallel. High current gain is achieved, since Q3 drives the bases of Q1 and Q2 in a Darlington circuit. The Q+ voltage is divided by resistors R12, R14, R15 and R16, and "A+" potentiometer R13. The sample voltage is applied from the arm of R13 to the base of reference regulator Q4. The emitter of Q4 is held constant at +6.8 volts by Zener diode CR18, which is kept in the breakdown state by resistor R11 connected to A+. "A+" control R13 is adjusted so that Q4 is conducting at the level needed to maintain the A+ voltage at 13.6 volts.

(2) Operation

If an increase in A+ output voltage occurs across capacitor C6, the increase is sensed at the arm of R13, increasing the forward base-to-emitter bias on reference regulator Q4. As a consequence, Q4 collector current increases and has the effect of "robbing" some of the base current to series regulator driver transistor Q3. This decreases base drive to Q1 and Q2. The collector-to-emitter voltage across Q1 and Q2 increases, reducing the A+ voltage back to its original level.

With a decrease in A+ output voltage, the voltage on the arm of R13 decreases. As a consequence, Q4 collector current decreases and Q3 base drive increases. The collector-to-emitter voltage of Q1 and Q2 decreases and the A+ voltage comes back to its original value as set by the A+ potentiometer.

The entire circuit action is almost instantaneous, so that the fluctuation in A+ voltage is only momentary.

e. Main Current Limiter

Limiting of the main dc load current through the power supply is obtained by sensing the current through R9, which is in series with the dc current path from series regulators Q1 and Q2. The base-to-emitter bias for current limiter control transistor Q6 is determined by the voltage drop across R9 due to the main dc load current through it and the drop across "C. L." potentiometer R8. R8 is adjusted so that, with a normal load on the power supply, the forward base-to-emitter bias voltage on Q6 is below the level needed to make it conduct. While Q6 is in this "normal load current" condition, it is cut off, and its collector draws no current from current source Q5.

If a heavy load on the power supply occurs, the increased dc output current will cause an increase in the voltage drop across resistor R9. This will cause the base of Q6 to become more positive while its emitter voltage remains unchanged.

As a result, Q6 turns on and decreases the drive current to Q3. Accordingly, transistors Q1 and Q2 start turning off and thereby drop the output voltage. The setting of C. L. potentiometer R8 determines at what output current the current limiting begins.

f. Overvoltage Protection

If the dc voltage at the output of the pre-regulator or the output of the series regulator increases sufficiently, CR17 starts to conduct in its Zener region. The voltage developed across R22 turns SCR3 on, which in turn removes the charging voltage to UJT Q8. This keeps the emitter of the UJT at nearly ground potential, preventing the UJT from firing and generating gate pulses for SCR1 and SCR2 in the main bridge rectifier. The lack of gate pulses prevents SCR1 and SCR2 from conducting and thereby disables the power supply completely.

(1) Output of Pre-Regulator

If the output voltage of the pre-regulator (voltage across C2) increases, the increase in voltage is sensed across R28 and R33, and the portion across R33 is applied through diode CR16 to the cathode of Zener diode CR17. If the increase in voltage across C2 is sufficiently high, Zener diode CR17 will "breakdown" and supply the current needed to the gate of SCR3 to shutdown the power supply.

(2) Output of Series Regulator

If the A+ voltage at the output of the series regulator increases, it is sensed through diode CR19 and applied to the cathode of Zener diode CR17. If the increase in voltage across C6 is sufficiently high, Zener diode CR17 will "breakdown" and apply the positive pulse needed to the gate of SCR3 to shut down the power supply.

(3) Resetting

In the event that the power supply is disabled by the overvoltage protection circuit as described, primary power (120 V ac) to the power supply must be interrupted in order to turn off SCR3.

g. Electronic Filter Circuit

The electronic filter circuit provides the necessary filtering action for the A+ source which supplies the low levels of the receiver(s) and transmitter.

Electronic filter transistor Q7, basically a capacitance multiplier, filters out spikes and any ripple that may appear on the A+ lines. If a spike occurs in the A+ output (across C6), it is coupled via R17 to the base of electronic filter Q7. The spike is integrated by R17 and C7 to reduce its amplitude and remove the sharp leading edge. As a consequence, the spike that appears at the emitter is attenuated. The electronic filter has an effect similar to a filter capacitor many times the size of C7.

h. Exciter/Transmitter Current Limiting and Protection Circuit

The current limiter circuit prevents excessive current in the rf power transistors due to detuning and short circuit. The protection circuit consists of two separate limiter circuits controlled from a common reference regulator. The circuit

operation for the driver transistor limiter is basically the same as for the final transistor limiters.

Transistor Q15 functions as a current limiter for the final transistor, and Q14 controls the base current to the limiter. R47 senses the current and varies the base-emitter voltage of Q14. Reference regulator transistor Q16 establishes a reference level for current limiter operation. When the current is lower than that of the preset (limiting) level, transistor Q14 is cut-off and Q15 is saturated. As more current is drawn through transistor Q15, the voltage drop across R47 increases. When the voltage across R47 becomes slightly greater than the fixed voltage at the emitter of Q14, the transistor becomes forward biased and its collector current reduces the base drive supplied to Q15. This in turn starts turning off Q15. The output current, therefore, cannot become greater than the preset level. If a short develops in the rf power transistor circuit, it will cause the output voltage to drop sufficiently to drive short-circuit detector Q19 into cut-off, removing the base bias voltage applied to Q16. This in turn cuts off the driver as well as the final transmitter limiters.

i. "Private-Line" Tone Generator

The tone generator consists basically of a two-stage oscillator (Q103 and Q104) and a tone amplifier (Q106). The frequency-determining element of the oscillator is a "Vibrasender" resonant reed (an electromechanical equivalent of a parallel-tuned high Q tank circuit). The output stage of the oscillator (Q104) provides a tone from both its emitter and its collector. Tones from the two outputs are of opposite phase to each other, with the Q104 emitter output supplying the PL tone during a transmission and the Q104 collector output supplying the out-of-phase tone (reverse burst) at the end of a transmission.

Passage of tones from one or the other output of oscillator stage Q104 to the base of tone amplifier Q106 is controlled by the PL Tone Gate and the Reverse Burst Gate. During a transmission, the PL Tone Gate is open, passing the tones from the emitter output of Q104 to tone amplifier Q106. (At this time, the Reverse Burst Gate is closed). When the operator releases his push-to-talk switch at the end of a transmission, the PL tone gate closes, terminating transmission of the in-phase "Private-Line" tone. Simultaneously, the reverse burst gate opens, passing the out-of-phase tone signal from Q104 to the tone amplifier. The out-of-phase tone signal is transmitted for a short interval (approximately 150 milliseconds) to provide a positive damping action for the "Vibrasponder" reed in the listening receiver.

The 150 millisecond delay is developed by PL reverse burst delay generator Q102. It delays the actual unkeying of the transmitter after the operator releases his push-to-talk switch, to permit transmission of the short burst of out-of-phase tone (described previously). At the end of the delay interval, the "delayed push-to-talk" output signal of Q104 (at pin P8-5) causes the transmitter to unkey.

An additional circuit (Q101) provides a "Private-Line" disable signal for the receiver(s) in the station using this board, when the PL disable mode is selected. Q101 is an inverter which is saturated when the receiver(s) are in their normal mode ("Private-Line" circuits in use). With Q101 saturated, the R1 and R2 PL disable lines are clamped to ground through diodes CR101 and 102, respectively. The "Private-Line" mode is disabled by application of a ground at the PL disable control input, pin P8-7. This turns off Q101, removing the ground connection to the PL disable output lines at pins 6 and 4 of P8.

(1) Standby (Unkeyed) State

In the unkeyed state, the "Push-to-Talk Control" signal at pin P8-3 is a positive voltage (approximately +12 volts) which is developed in the local or remote control unit. Diode CR103 is reverse-biased because its cathode is at a higher positive voltage than its anode. The anode voltage for CR103 is taken from a voltage divider comprised of R124, R122 and R123 between the +8.8 volt bus and ground. Approximately +0.6 volt is applied from the voltage divider to the base of reverse burst switch Q105, holding Q105 in saturation. The grounded collector of Q105 reverse-biases CR106, whose cathode is connected via R131 to a positive voltage tap (+3.9 volts) on a voltage divider comprised of R129 and R126 between the +8.8 volt bus and ground.

With CR106 reverse-biased, the cathode of CR108 assumes a positive voltage much lower than the 5.4 volts on its anode. CR108 is therefore forward-biased while the transmitter is unkeyed. At the same time, the positive voltage at the junction of R124 and R122 is applied via R125 to the anode of CR105, forward-biasing it and applying a positive voltage via R128 to the cathode of CR107 sufficient to reverse-bias CR107.

Reverse burst delay generator Q102 is at this time held in saturation, as follows. The positive

voltage applied at pin P8-3 keeps capacitor C101 essentially uncharged. (CR103 being reverse-biased acts as an open circuit.) The base voltage of Q102 is approximately 0.7 volt less positive than the A+ voltage at its emitter, forward-biasing the base-emitter junction. (The base voltage is determined by a voltage divider comprised of R106, CR104, R104 and R105 between A+ and ground.) With Q102 saturated, its collector voltage is 12.7 volts and the "delayed push-to-talk" signal at pin P8-5 is approximately the same value.

(2) Transmit (Keyed) State

When the transmitter is keyed, a ground (nominal zero volts) is applied to the "push-to-talk control" input (pin P8-3). This ground forward-biases CR103, grounding the base of reverse burst switch Q105 and turning it off. The Q105 collector voltage rises to approximately 6.6 volts, forward-biasing CR106 and applying a positive voltage via R132 to the cathode of CR108. This reverse-biases CR108, preventing tone signals from C108 from passing through CR108 to the base of tone amplifier Q106. With the ground provided by the "P-T-T Control" signal, diode CR103 clamps the junction of R122 and R124 to ground, removing the forward bias on CR105. With CR105 reverse-biased, the cathode voltage of CR107 drops to a much lower positive voltage tapped off the R129-R126 voltage divider. With 5.4 volts on its anode, CR107 is forward-biased, allowing the "forward-phase" tone signal to pass through it to the base of amplifier Q106. (The complete tone-path is from the emitter of Q104, through JU1, R120, JU2, C106, C107 and CR107 to the base of Q106.)

When the transmitter is keyed, the P-T-T control signal at P8-3 grounds the negative side of C101, causing C101 to charge rapidly to approximately 12 volts. Reverse burst delay generator Q102 remains on while transmitting however, because its emitter voltage (12.8 volts) is still more positive than its base.

(3) End of Audio Transmission

When the operator releases his push-to-talk switch at the end of the transmission, the transmitter does not unkey immediately. It continues to transmit an rf carrier for approximately 150 milliseconds, modulated only by a reverse-phase PL tone. During this short burst, the PL tone, being out of phase with the original PL tone, provides a damping action to the "Vibrasponder" reed in the listening receiver. Positive damping of the "Vibrasponder" is necessary to prevent it from "ringing" for a short interval after the normal PL tone ends, which would cause a "squelch tail" in the listening receiver(s).

The 150 millisecond delay is provided by the "delayed P-T-T" output signal of reverse burst delay generator Q102. When the push-to-talk switch is released, the P-T-T control signal at P8-3 returns to +12 volts. Capacitor C101 which was charged during P-T-T operation is now discharged thru R104 and R105, momentarily back-biasing CR104. This removes drive from Q102, resulting in Q102 cutoff. The delayed P-T-T signal at P8-5 is then maintained at near ground potential by current thru R108 and R107. When C101 becomes completely discharged (approximately 150 milliseconds after P-T-T control is removed) Q102 will turn on, being again driven by current through R104 and R105. This causes a high positive potential (12.7 volts) being applied to the junction of R107 and R108, which removes the ground drive from delayed P-T-T, resulting in transmitter turn off.

4. POWER SUPPLY ADJUSTMENT PROCEDURE

EQUIPMENT REQUIRED:

1. A dc voltmeter with sensitivity of 20,000 ohms/volt or better.
2. A 1.0 ohm, 200 watt resistor.

The power supply must be properly adjusted in order for the regulator circuits to function correctly. Refer to Figure 3 the Power Supply Detail, for the locations of potentiometers to be adjusted.

Use the following procedure to set the voltage and current-limiting levels in the power supply.

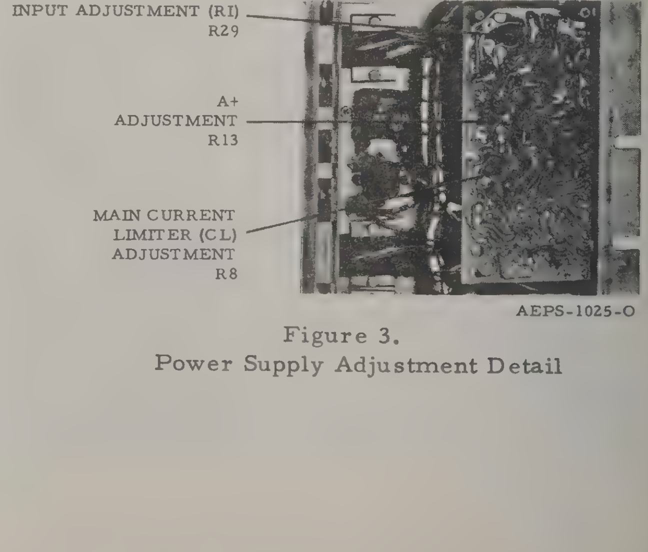


Figure 3.
Power Supply Adjustment Detail

a. Set the R. I. potentiometer R9 fully clockwise as viewed from the plated side of the board.

b. Set C. L. potentiometer R8 fully clockwise.

c. Key the transmitter.

d. Adjust A+ potentiometer R13 for exactly 13.6 volts at terminal TB1-2 on the power supply.

e. Turn R. I. potentiometer R29 counterclockwise until the collector-to-emitter voltage of Q1 and Q2 is exactly 4.3 volts.

NOTE

Make sure that transmitter is keyed.

f. Unkey the transmitter and disconnect transmitter plug P6 from connector J6 on the power supply. Also disconnect power amplifier plug P7 from connector J7.

g. Connect a 1.0 ohm, 200 watt resistor between terminals 2 and 3 of TB1 on the power supply chassis.

h. Turn C. L. potentiometer R8 until the A+ voltage just begins to fall.

i. Remove the 1.0 ohm load resistor and connect all plugs.

5. TROUBLESHOOTING

Use standard troubleshooting techniques to isolate a power supply malfunction to a particular stage. Compare the voltage readings to those on the schematic diagram to determine the faulty component. Waveforms A, B, C and D are provided on the schematic diagram for checking circuit operation at those key points.

a. Loading

Power supply troubleshooting should begin with a normal load (or simulated normal load) applied. If either an overvoltage or overcurrent condition exists, the power supply should be disconnected from its normal load and appropriate dummy load resistors connected. The dummy load resistors used should total 1.25 ohms ±10% at 200 watts. They are connected between TB1-2 and TB1-3 on the power supply.

b. Voltage Measurements

Normal voltage measurements in the power supply circuit are shown on the power supply schematic diagram. Voltages are given for a full load (transmitter keyed) and also for the standby condition (transmitter unkeyed).

6. SERVICE AIDS

a. Parts Location

Location of electrical parts within the power supply are shown in Figures 4, 5, and 6.

b. Circuit Board Removal

(1) Complete removal of the regulator-limiter printed circuit board for access to the components is not necessary. The circuit board can be folded away from the power supply chassis to expose the components, after first removing the four mounting screws. Fold the board out and to the right of the power supply chassis.

(2) To remove the "Private-Line" tone generator board; (a) remove the five mounting screws; (b) unplug the board carefully from its receptacle.

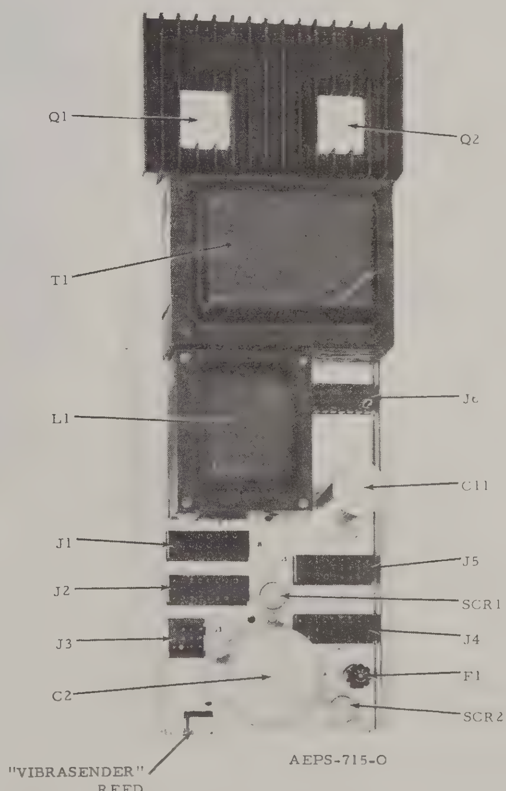


Figure 4.
Power Supply Parts Location Detail (Front View)

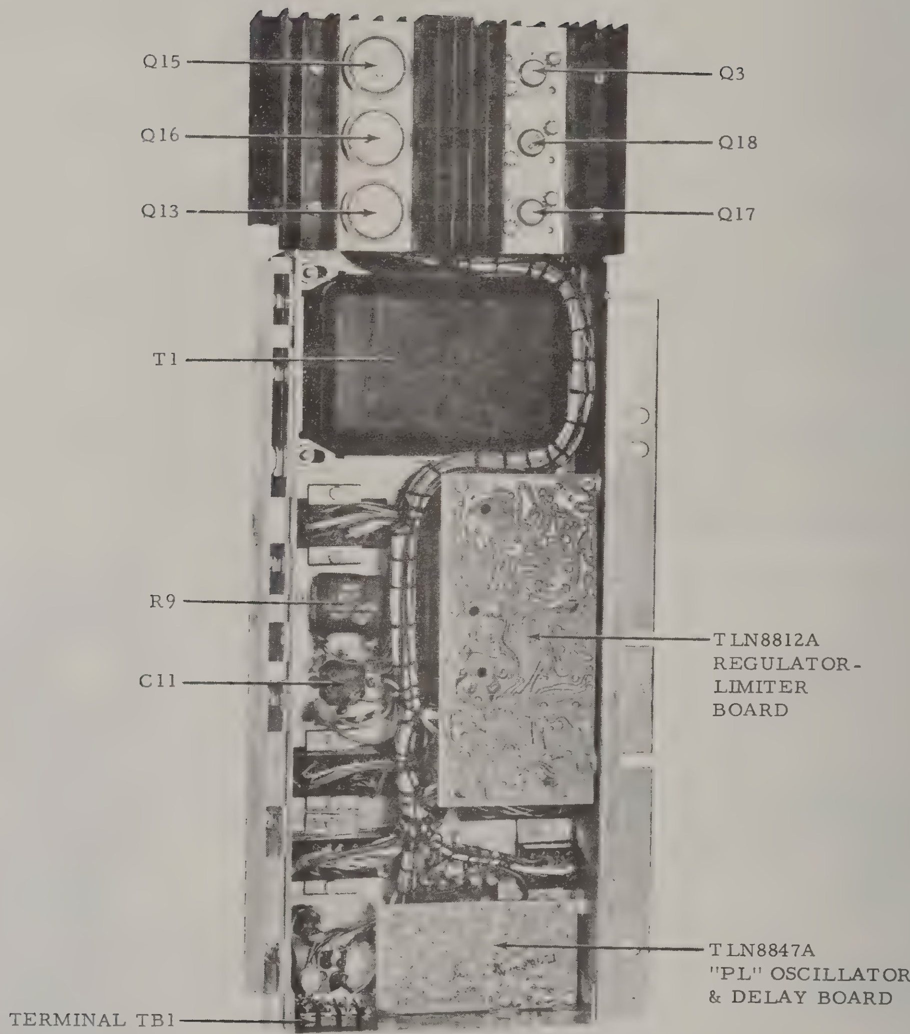
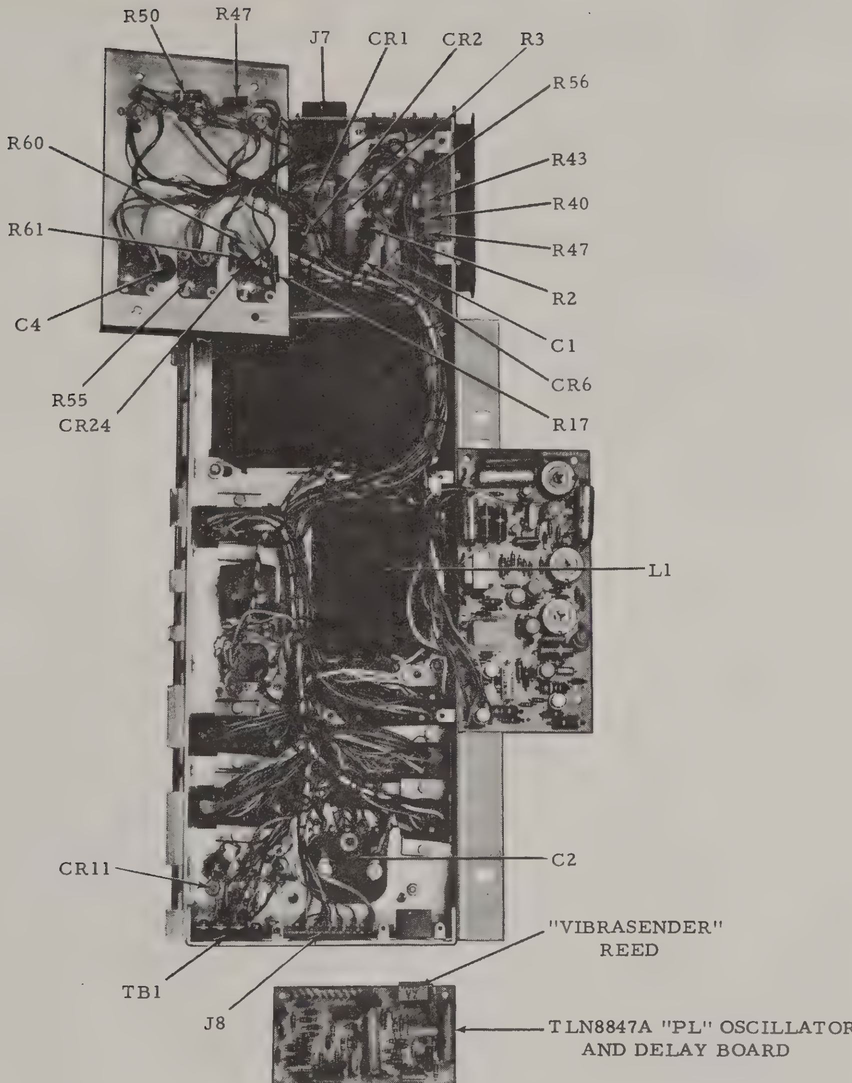


Figure 5.
Power Supply Parts Location Detail
(Rear View)



AEPS-717-O

Figure 6.
Power Supply Parts Location Detail
(Rear View, Subassemblies Removal)

c. Power Transistor Removal (Heat-Sink Mounted Units)

To remove a heat-sink mounted power transistor:

(1) Using a 1/4-inch hex-nutdriver, remove the four metal-tapping screws holding the heat-sink to the chassis.

(2) Unsolder all lead(s) from the base and emitter pins on the transistor.

(3) Remove the two mounting screws and pull the transistor out of its socket. Exercise care so as not to damage the mica insulator between the transistor case and heat-sink.

d. Power Transistor Replacement

Replacement of type M9394 power transistors must be done carefully to ensure that the mica washers and insulating sleeves are installed correctly. Failure to do so may cause arcing to the chassis with resultant damage to the power transistor(s). Refer to Figure 7. Power Transistor Assembly Detail for proper orientation of the various parts when installing an M9394 transistor (reference designations Q213, Q215 and Q216).

When replacing a power transistor, inspect the mica insulator for cracks or tears, and replace if defective. If a new transistor is being installed, always discard the old mica insulator and install the new one supplied with the transistor.

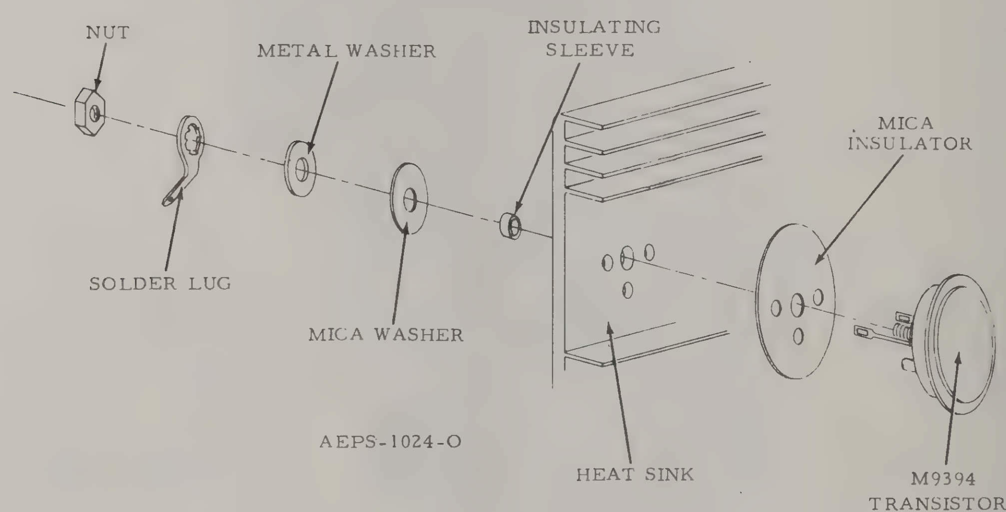
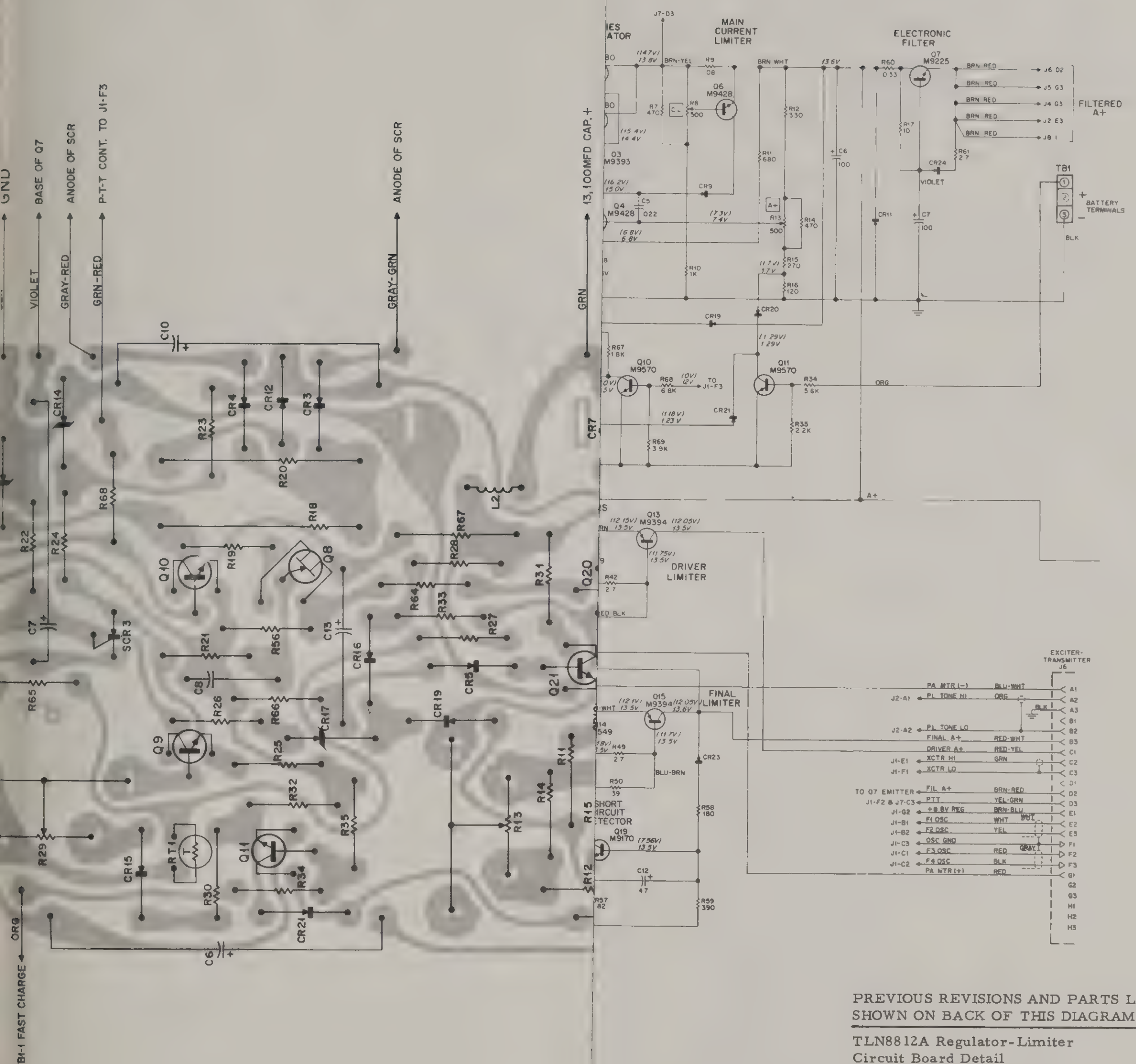


Figure 7.
Power Transistor Assembly Detail



POWER SUPPLY

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8812A Regulator-Limiter
Circuit Board Detail
Motorola No. PEPS-4025-B
9/1/71-UP

c. Power Transistor Removal (Heat-Sink Mounted Units)

To remove a heat-sink mounted power transistor:

(1) Using a 1/4-inch hex-nutdriver, remove the four metal-tapping screws holding the heat-sink to the chassis.

(2) Unsolder all lead(s) from the base and emitter pins on the transistor.

(3) Remove the two mounting screws and pull the transistor out of its socket. Exercise care so as not to damage the mica insulator between the transistor case and heat-sink.

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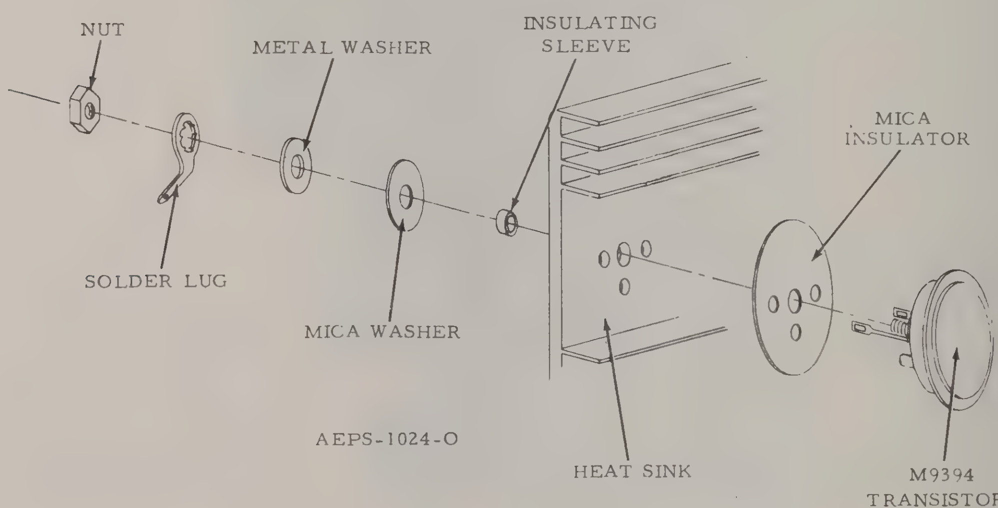
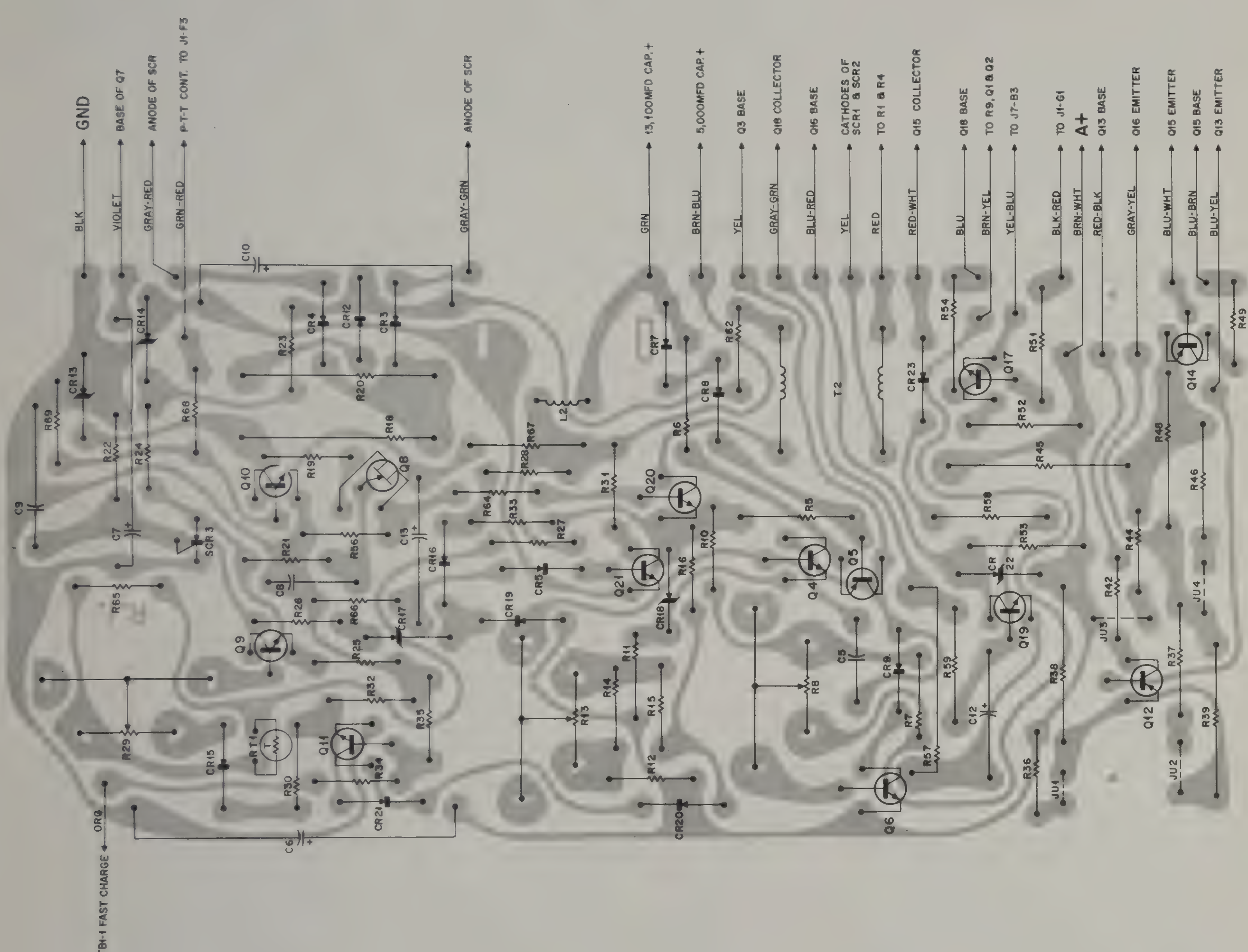
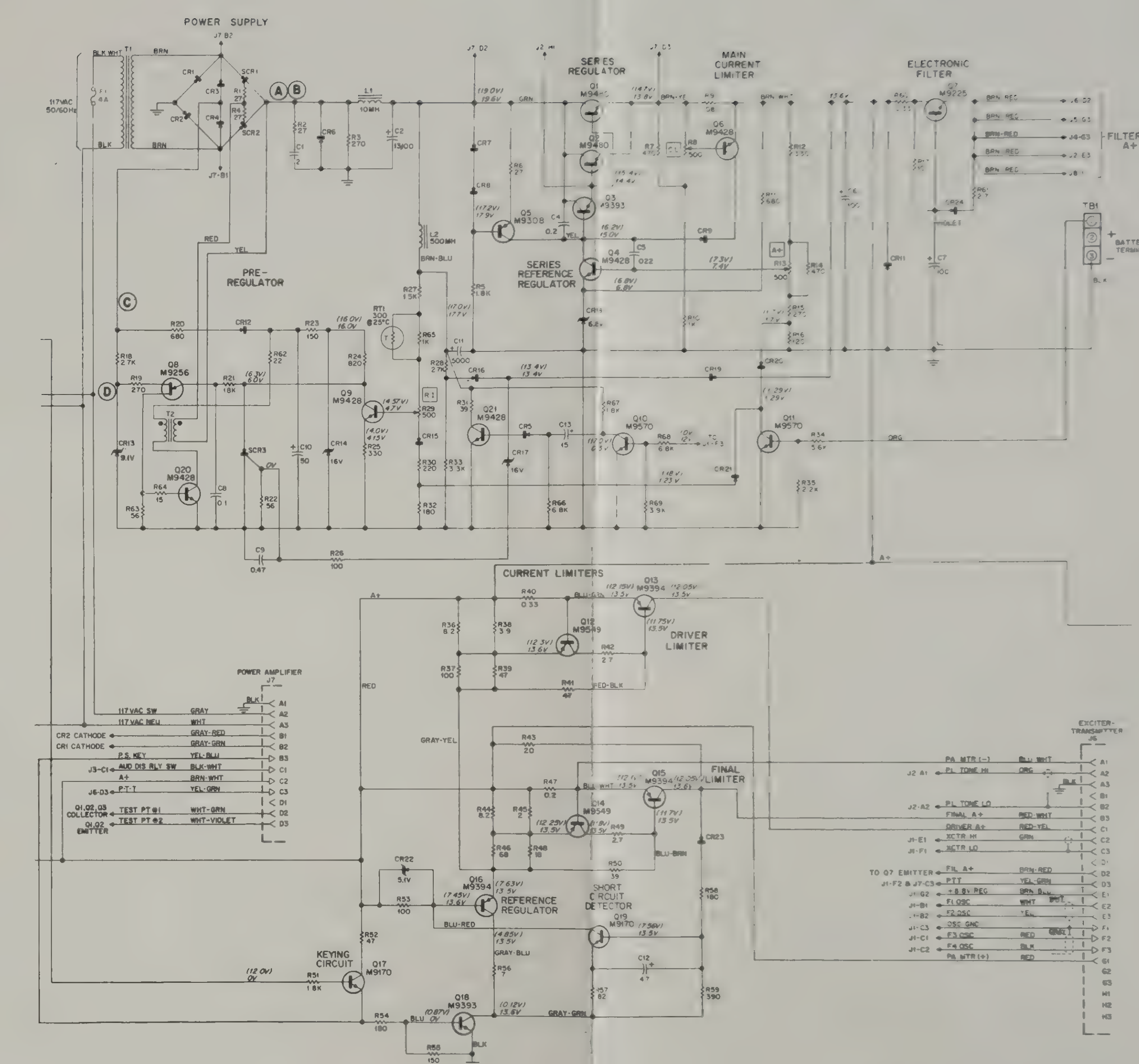


Figure 7.
Power Transistor Assembly Detail

POWER SUPPLY





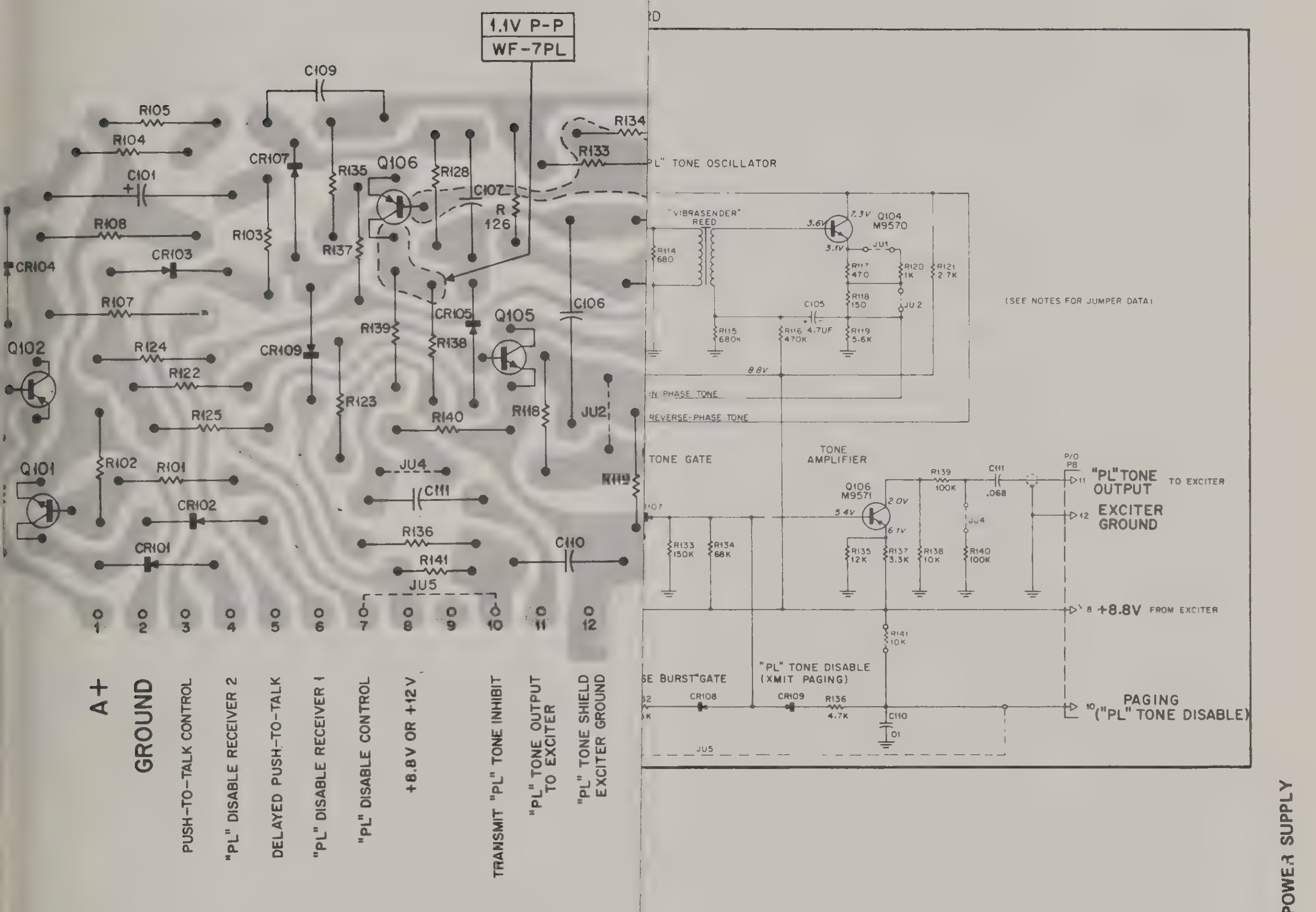
POWER SUPPLY

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8812A Regulator-Limiter
Circuit Board Detail
Motorola No. PEPS-4025-B
9/1/71-UP

CE L	MOTOROLA PART NO.	DESCRIPTION
	25C83039H01	TRANSFORMER, pulse: bifilar; res (each winding) 1.5 ohms max
	6B865641	THERMISTOR: 300 ohms

acement diodes and transistors must be ordered by
rola part number only for optimum performance.



PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8847A-1 "Private-Line" Oscillator & Delay (Encoder) Circuit Board Detail
Motorola No. PEPS-469-C
9/1/71-UP

REVISIONS

PEPS-4025-B

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8812A-1	Q5	WAS 48R869571, M9571	SCHEM. & PARTS LIST

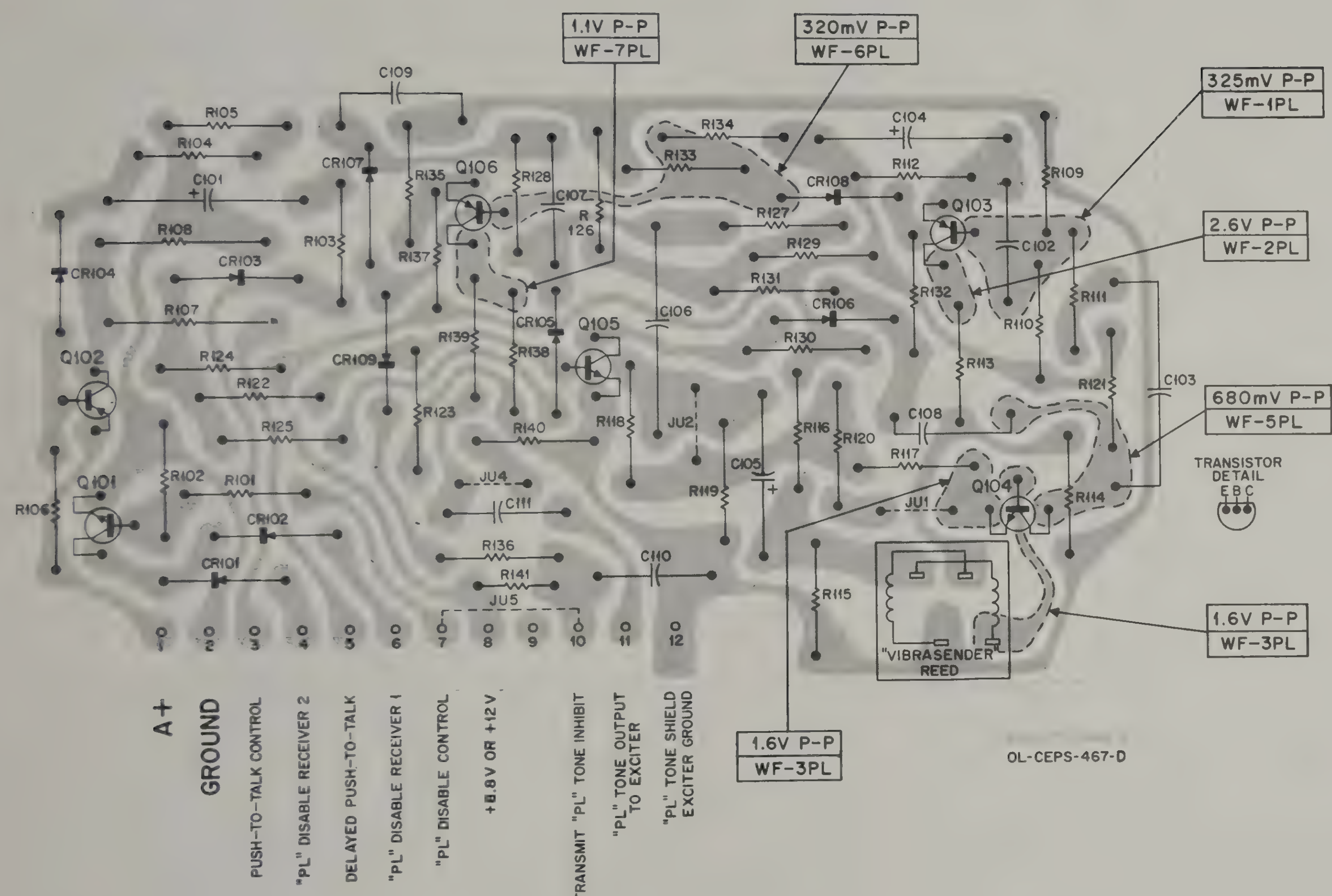
PARTS LIST

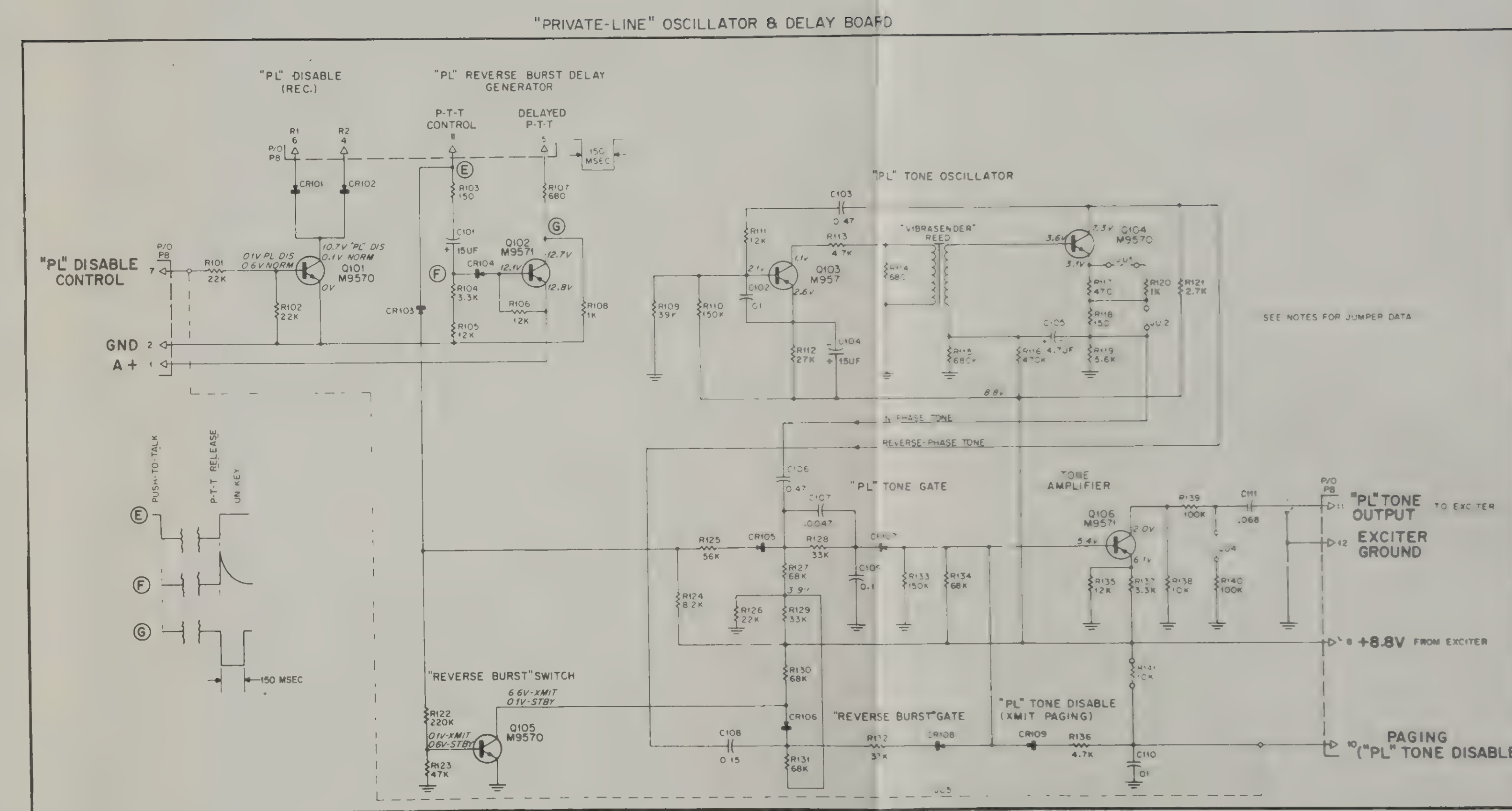
TLN8812A Regulator Limiter Board PL-185-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; ±10%; 50 v; unl stated
C5	8D82905G02	.022
C6	23D82601A19	100 +60-0%; 25 v
C7	23D82601A25	100 +150-10%; 20 v
C8	8C83514G02	0.1
C9	8C82905G33	0.47 ±20%
C10	23C82601A36	50 +150-10%; 35 v
C12	23D82783B25	4.7; 25 v
C13	23D83214C02	15 ±20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR3, 4	48C82466H02	silicon
CR5, 9, 15, 16, 20, 21, 23	48C82392B03	silicon
CR7, 8, 19	48C82392B05	silicon
CR12	48C82466H01	silicon
CR13	48D82256C43	silicon; zener type; 9.1 v
CR14	48C83461E07	silicon; zener type; 16 v ±10%
CR17	48D83461E01	silicon; zener type; 16 v ±5%
CR18	48D82256C37	silicon; zener type; 6.8 v
CR22	48D82256C51	silicon; zener type; 5.1 v
SCR3	48R869577	silicon; controlled type
		REACTOR:
L2	25B82349A01	power filter choke; 500 mH
		TRANSISTOR: (NOTE)
Q4, 6, 9, 20, 21	48R869428	N-P-N; type M9428
Q5	48R869308	N-P-N; type M9308
Q8	48R869256	unijunction; type M9256
Q10, 11	48R869570	N-P-N; type M9570
Q12, 14	48R869549	P-N-P; type M9549
Q17, 19	48R869170	N-P-N; type M9170
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R6	6S5683	27; 1/2 w
R7	6S127801	470
R8, 13	18C83168C01	variable: 500 ±20%; 2 w
R10, 65	6S127802	1K
R11	6S128599	680
R12	6S129806	330 ±5%
R14	6S129708	470 ±5%
R16	6S124A27	120 ±5%
R18	6S5764	2.7K; 2 w
R19	6S129752	270
R20	6S490015	680; 2 w
R21	6S128904	18K
R22, 63	6S129860	56
R23	6S129862	150
R24	6S129432	820
R25	6S129775	330
R26	6S129753	100
R27	6S127803	1.5K
R28	6S128688	2.7K
R29	18C83168C01	variable: 500 ±20%; 3 w
R31	6S131652	39
R32	6S129662	180
R33	6S129231	3.3K
R34	6S129433	5.6K
R35	6S128689	2.2K
R36, 44	6S124B67	8.2 ±5%
R37, 53	6S6326	100; 1/2 w
R38	17K837834	3.9 ±5%
R39	6S5583	47 ±5%; 1 w
R42, 49	6S124B55	2.7 ±5%
R45	17K847359	2 ±2%; 1 w
R46	6S2039	68; 1/2 w
R48	17C82036G27	18 ±5%; 2 w
R52	6S5550	47; 1/2 w
R54, 58	6S5660	180; 1/2 w
R57	6S488222	82; 2 w
R59	6S5554	390; 1/2 w
R62	6S131641	22
R64	6S131377	15
R66, 68	6S129687	6.8K
R69	6S129232	3.9K

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER, pulse:
T2	25C83039H01	bifilar; res (each winding) 1.5 ohms max
		THERMISTOR:
RT1	6B865641	300 ohms

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

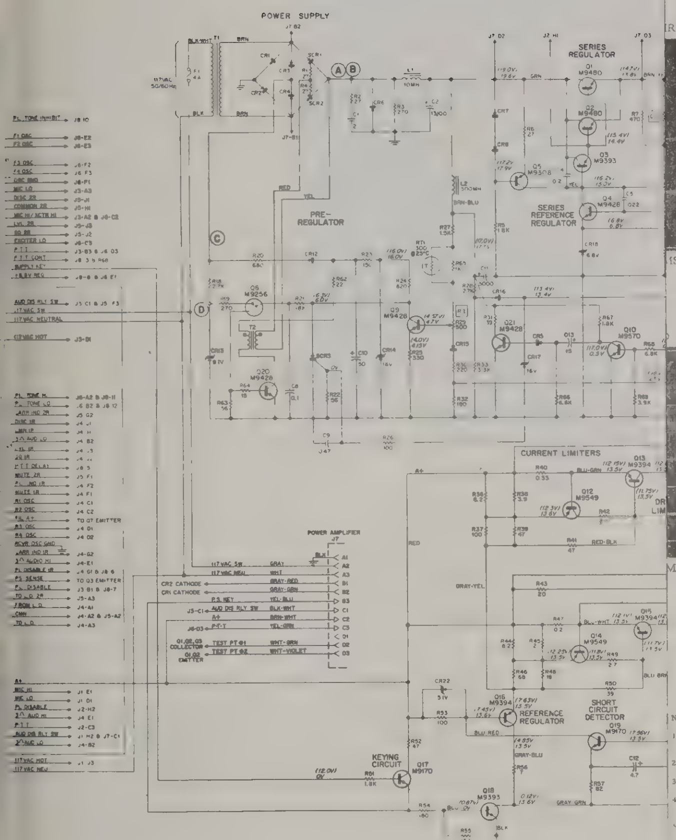




POWER SUPPLY

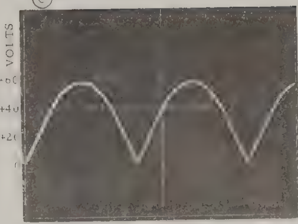
PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8847A-1 "Private-Line" Oscillator & Delay (Encoder) Circuit Board Detail
Motorola No. PEPS-469-C
9/1/71-UP



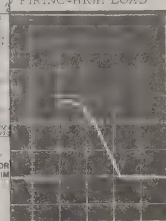
IRING-NORMAL LOAD

MSEC/DIV

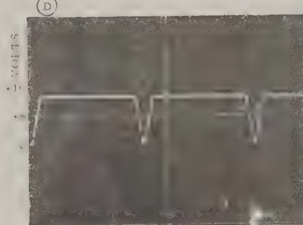


2 MSEC/DIV

FIRING-HIGH LOAD



MSEC/DIV



2 MSEC/DIV

AEPS-1017-O

NOTES:

1. UNLESS OTHERWISE STATED.
   ALL CAPACITOR VALUES ARE IN MICROFARADS;
   ALL RESISTOR VALUES ARE IN OHMS (K=1000).
2. COMPONENT REFERENCES WITHIN RECTANGLES ARE MARKED ON THE CHASSIS.
3. CIRCLED LETTERS INDICATE THE POINT AT WHICH EACH WAVEFORM APPEARS.
4. ALL DC VOLTAGE MEASUREMENTS TAKEN WITH RESPECT TO CHASSIS, USING A METER HAVING AN INPUT RESISTANCE OF 20K OHMS-PER-VOLT OR HIGHER.
5. JU1, JU2, JU4 - ANY ONE OR ALL MAY BE CUT IN FACTORY TO ADJUST OSCILLATOR OUTPUT LEVEL TO MATCH SYSTEM REQUIREMENTS. JU3 IS CUT WHEN STATION HAS PAGING CAPABILITY. JU5 IS CONNECTED ONLY IN DC REMOTE CONTROL STATIONS WITH PAGING CAPABILITY.

EPS-1439-A

POWER SUPPLY

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Power Supply Schematic Diagram
Motorola No. 63E81010E86-C
9/1/71-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

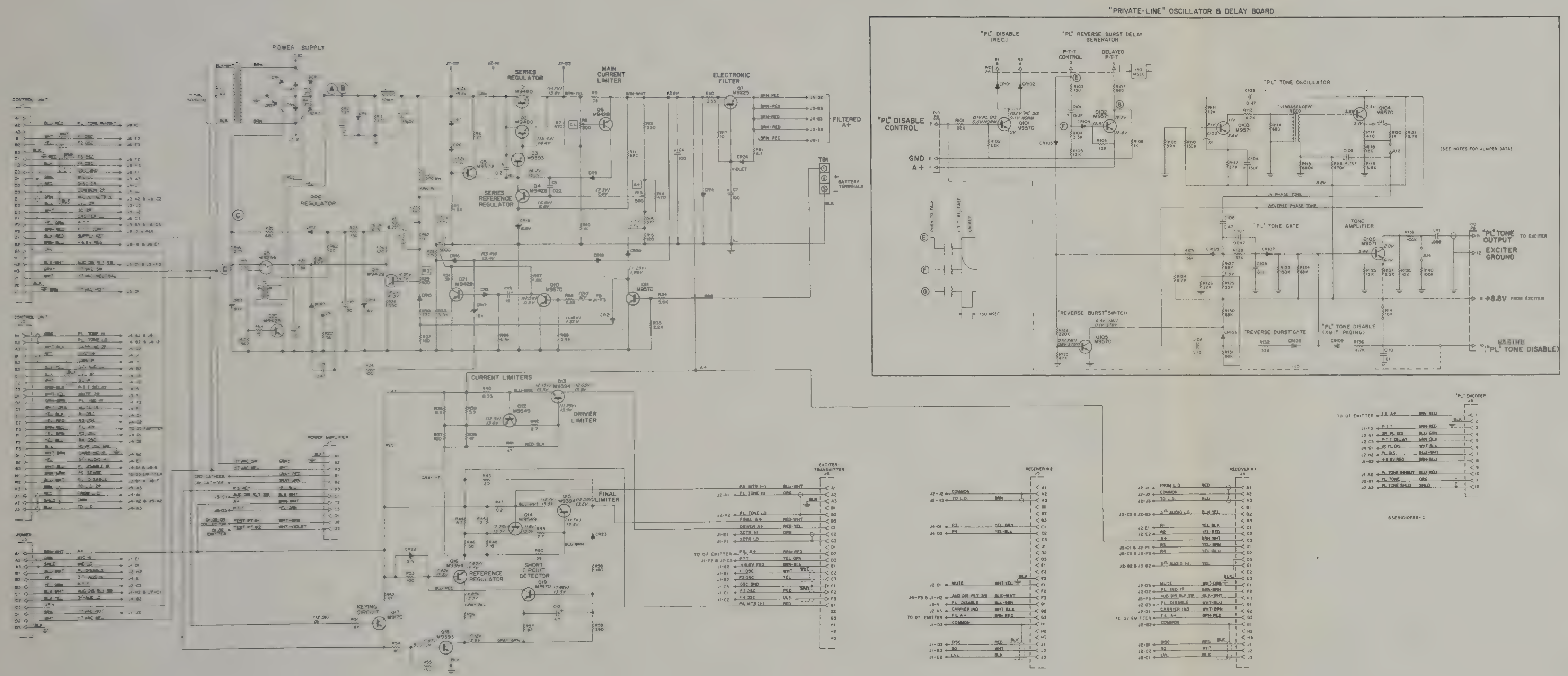
TLN8847A "Private-Line"
Oscillator & Delay Board

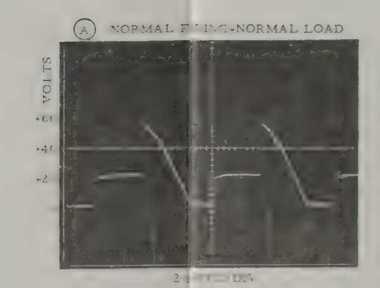
PL-293-C

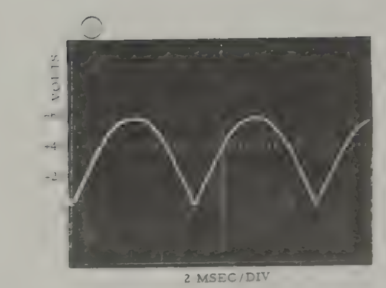
		CAPACITOR, fixed: uF; 50 v; unl stated
C101	23D82783B24	15 ±10%; 25 v
C102, 110	8D82905G01	.01 ±10%
C103, 106	8D82905G33	0.47 ±20%
C104	23K865136	15 ±20%; 25 v
C105	23K865137	4.7 ±10%; 25 v
C107	8D82905G26	.0047 ±10%; 100 v
C108	8D82905G05	0.15 ±10%
C109	8D82905G07	0.1 ±10%
C111	8D82905G04	.068 ±10%
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101 thru 109	48C82392B03	silicon
		TRANSISTOR: (SEE NOTE)
Q101, 104, 105	48R869570	N-P-N; type M9570
Q102, 103, 106	48R869571	P-N-P; type M9571
		RESISTOR, fixed; ±5%; 1/4 w; unl stated
R101, 102	6S128685	22K ±10%
R103	6S129862	150 ±10%
R104, 137	6S124A60	3.3K
R105, 106, 111, 135	6S129887	12K
R107	6S129984	680
R108	6S6411	1K; 1/2 w
R109	6S129777	39K
R110, 133	6S128683	47K ±10%
R112	6S129886	27K
R113, 136	6S129669	4.7K
R114	6S5651	680; 1/2 w
R115	6S131857	680K
R116	6S129149	470K
R117	6S129709	470
R118	6S131276	150
R119	6S129982	5.6K
R120	6S129805	1K
R121	6S129707	2.7K
R122	6S129147	220K ±10%
R123	6S128902	47K ±10%
R124	6S128686	8.2K ±10%
R125	6S128684	56K
R126	6S129667	22K
R127, 130, 131, 134	6S129299	68K
R128, 129, 132	6S129526	33K
R138, 141	6S129668	10K
R139, 140	6S124A97	100K

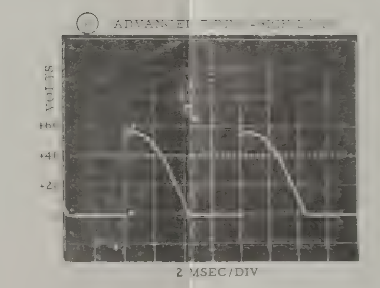
NOTE:

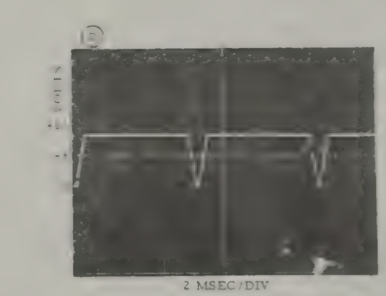
For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.











AEPS-1017-O

POWER SUPPLY

NOTES:

1. UNLESS OTHERWISE STATED
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
   ALL RESISTOR VALUES ARE IN OHMS (K=1000)
2. COMPONENT REFERENCES WITHIN RECTANGLES ARE MARKED ON THE CHASSIS.
3. CIRCLED LETTERS INDICATE THE POINT AT WHICH EACH WAVEFORM APPEARS.
4. ALL DC VOLTAGE MEASUREMENTS TAKEN WITH RESPECT TO CHASSIS [illegible] A METER HAVING AN INPUT RESISTANCE OF 20K OHMS-PER-VOLT [illegible]R.
   [illegible] JU4 - ANY ONE OR ALL MAY BE CUT IN FACTORY TO [illegible]ATOR OUTPUT LEVEL TO MATCH SYSTEM RE-[illegible]EMENTS. JU3 IS CUT WHEN STATION HAS PAGING CAPABILITY. [illegible] CONNECTED ONLY IN DC REMOTE CONTROL STATIONS [illegible]H PAGING CAPABILITY.

EPS-1439-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Power Supply Schematic Diagram
Motorola No. 63E81010E86-C
9/1/71-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<u>TRANSFORMER, power:</u>
T1	25D83971G01	pri: BLK, BLK-WHT; res 0.225 ohms ±10% sec: BRN, BRN; res .005 ohms ±10%
		<u>TERMINAL BOARD:</u>
TB1	31B84002A01	3 dual screw terminals
		<u>FUSEHOLDER:</u>
XF1	9C82083C03	extractor post type
		<u>SOCKET, transistor:</u>
XQ1, 2	9D82673A01	2 contact
XSCR1, 2	9D82673A01	2 contact
XQ3, 7, 18	9B83662A01	2 contact
	NON-REFERENCED ITEMS	
	1V80781A90	HEAT SINK ASSEMBLY: (front); incl. transistor sockets XQ1, 2
	1V80781A92	HEAT SINK ASSEMBLY: (rear); incl. transistor sockets XQ3, 7, 18
	7A83959A01	PLATE, heat sink; (top); used for mtg CR1, 2
	64B83562D01	PLATE, heat sink; (bottom); used for mtg CR6

NOTE:

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

2meter
BE0166
175watt
2600 m
0.6wrc?
14w
100watt
STR RSP
TO00KG6TR

REVISIONS

63E81010E86-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
TLN8812A-1				REGULATOR-LIMITER BD. PEPS-4025-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

PARTS LISTS FOR PRINTED CIRCUIT BOARDS ARE ON THE BACK OF THE CORRESPONDING PRINTED CIRCUIT BOARD DETAILS

TPN1089A Power Supply (Formerly Model TPN1061AA-SP4 & TPN1061AC-SP10) PL-1024-A

		CAPACITOR, fixed: uF:
C1	8C82045E05	2.0 ±10%; 350 V
C2	23D82464C06	13100 +75-10%; 40 V
C4	21C82372C05	0.2 +80-20%; 25 V
C11	23D82304B16	5000 +150-10%; 35 V
C14	8D82905G04	.068 ±10%; 50 V (used in carrier squelch models only)
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 6	48C82732C11	silicon
CR11	48C82525G01	silicon
CR24	48C82392B03	silicon
SCR1, 2	48R869306	silicon; controlled type; does not incl. 14K865854 INSULATOR, mounting
		FUSE, cartridge:
F1	65K834464	4 A; 125 V
		CONNECTOR, rdceptacle:
J1, 2, 4, 5		incl. 14C83783A08 BODY, 29C82335A01 TERMINAL, contact; male; 29C82336A01 TERMINAL, contact: female (p/o J1, J2 only)
J3		incl. 14C82337A03 BODY 29C82336A01 TERMINAL, contact; female
J6		incl. 14C83783A03 BODY 29C82335A01 TERMINAL, contact; male; 29C82336A01 TERMINAL, contact; female
J7		incl. 14C82689A01 BODY 29C82335A01 TERMINAL, contact; male; 29C82336A01 TERMINAL, contact; female
		TERMINAL BOARD:
J8	1V80700B15	12 female contact terminals
		REACTOR:
L1	25D83967G01	power filter choke; 10 mH; res 0.1 ohm
		TRANSISTOR:
Q1, 2	48R869480	N-P-N; type M9480; does not incl. 14A82360D01 SLEEVE insulating: (for transistor mtg screws)
Q3, 18	48R869393	N-P-N; type M9393; does not incl. 14A83575A01 INSULATOR, mounting; 14A82360D01 SLEEVE, insulating: (for transistor mtg screws)
Q7	48R869225	N-P-N; type M9225
Q13, 15, 16	48R869394	P-N-P; type M9394; does not incl. 14A82923G01 INSULATOR, mounting; mica; 1-1/4' o.d.; 4C82418B64 SLEEVE, insulating: (for transistor mtg stud)
		RESISTOR, fixed: ±10%; 5 W; unl. stated
R1, 4	6S131594	27; 1/4 W
R2	6S5676	27; 1 W
R3	6C82394D12	270; 7 W
R9	17C83212C02	.08; 30 W
R17	6R488022	10; 1 W
R40	17C82586H04	.033 ±5%
R41	6S126A17	47 ±5%; 1 W
R43	17D82177B07	20 ±5%
R47	17C82586H01	0.2 ±5%
R50	6S400436	39 ±5%; 1 W
R55	6S129862	150; 1/4 W
R56	17K865603	7
R60	17C82350A11	0.33; 1 W
R61	6S124D55	2.7; 1/4 W

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER, power:
T1	25D83971G01	pri: BLK, BLK-WHT; res 0.225 ohms ±10% sec: BRN, BRN; res .005 ohms ±10%
		TERMINAL BOARD:
TB1	31B84002A01	3 dual screw terminals
		FUSEHOLDER:
XF1	9C82083C03	extractor post type
		SOCKET, transistor:
XQ1, 2	9D82673A01	2 contact
XSCR1, 2	9D82673A01	2 contact
XQ3, 7, 18	9B83662A01	2 contact
	NON-REFERENCED ITEMS	
	1V80781A90	HEAT SINK ASSEMBLY: (front); incl. transistor sockets XQ1, 2
	1V80781A92	HEAT SINK ASSEMBLY: (rear); incl. transistor sockets XQ3, 7, 18
	7A83959A01	PLATE, heat sink; (top); used for mtg CR1, 2
	64B83562D01	PLATE, heat sink; (bottom); used for mtg CR6

NOTE:

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

2meter:
BS2166
135watt
[illegible]
0.6wrc?
14w 100watt
SDR RSP
TOOLKGGTR

HIGH VOLTAGE POWER SUPPLY

MODEL TPN1090A

(FORMERLY MODEL TPN1041B-SP1)

WARNING--HIGH VOLTAGE

Extreme care should be exercised when servicing this equipment. Do not defeat interlock switches. It is a good practice to assume that HIGH VOLTAGES are present at all times, even after the ac power is removed from the station.

INTRODUCTION

This 120-volt, 50-60 Hz power supply provides necessary operating voltages for the power lifier. The outputs are as shown in Table 1.

TABLE 1.

OUTPUT	APPLICATION
Filament Voltage	PA Filaments
-50 volts	Bias
+300 volts at 185 mA	B+
+1500 volts at 400 mA	B++

2. CIRCUIT DESCRIPTION

a. General

Refer to the schematic diagram. When switch S2 is closed (MAIN POWER ON-OFF), 120 V ac

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ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

is applied to the primaries of transformers T4 and T5. Transformer T4 has two secondary windings; the first supplies bias voltage for the exciter and for the power amplifier stage; the second steps down the 120 V ac to 13.5 V ac for the driver filaments. A special transformer (T5) provides regulated 5.5 V ac for the power amplifier filaments.

b. High Voltage "Turn-On" Circuit

The following conditions must exist before 120 V ac will be applied to the primary transformer T2: (1) the main power and high voltage switches must be closed (ON), (2) interlock circuits must be completed (24 V dc applied to interlock relay [K1]), (3) a positive voltage (0.9 V minimum) must be applied to the gates of silicon controlled rectifiers (SCRs) CR1 and CR2. The primaries of the B+ and B++ circuits of the power supply are controlled by solid-state switching circuits rather than relays. The SCRs are reverse-biased until a positive voltage appears at the gate. Closing the P-T-T circuit causes a positive voltage to be applied to the base of transistor Q1. Refer to Figure 1.

This positive voltage biases Q1 into conduction and provides the primary winding of transformer T1 with a low impedance path to ground. The other side of T1 is connected through a phase shifting capacitor (C1) to a 13.5 V ac supply (secondary of T4). The voltages induced in the secondaries of T1 are applied to the gates of the SCRs through diodes CR6 and CR7 to gate the SCRs into conduction and switch 117 Vac to the primaries of T2 and T3. The surge suppressor diode (CR5) protects the SCR switching circuit against high voltage transients by gating the SCRs "on" during the presence of power line transients which might exceed the reverse breakdown rating of the SCRs.

The thyrector diode (CR5) is a semiconductor device used as a transient voltage suppressor. This back-to-back diode protects the SCRs against high voltage transients by having a lower avalanche voltage characteristic than the SCR reverse breakdown voltage.

c. 1500-Volt Circuit

When 120 volts ac is applied to the primary of transformer T2, the secondary voltage is stepped up, rectified by a diode bridge circuit, and filtered before it is applied to the power amplifier. A voltage divider circuit (R16 and R17) from the +1500-volt line provides a tap for plate voltage metering. Plate current is measured across a 4-ohm resistor (R19) in series with the ground return side of the 1500-volt filter circuit. The input to the overload bistable is also obtained from this point.

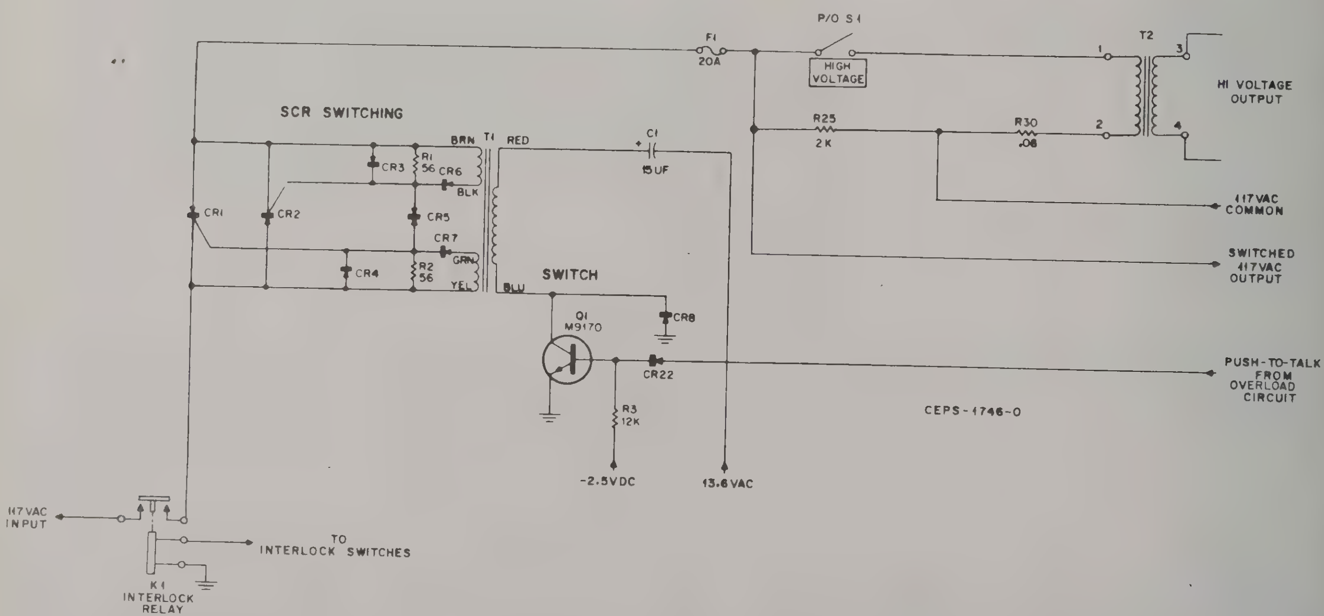


Figure 1.
High Voltage "Turn-On" Circuit

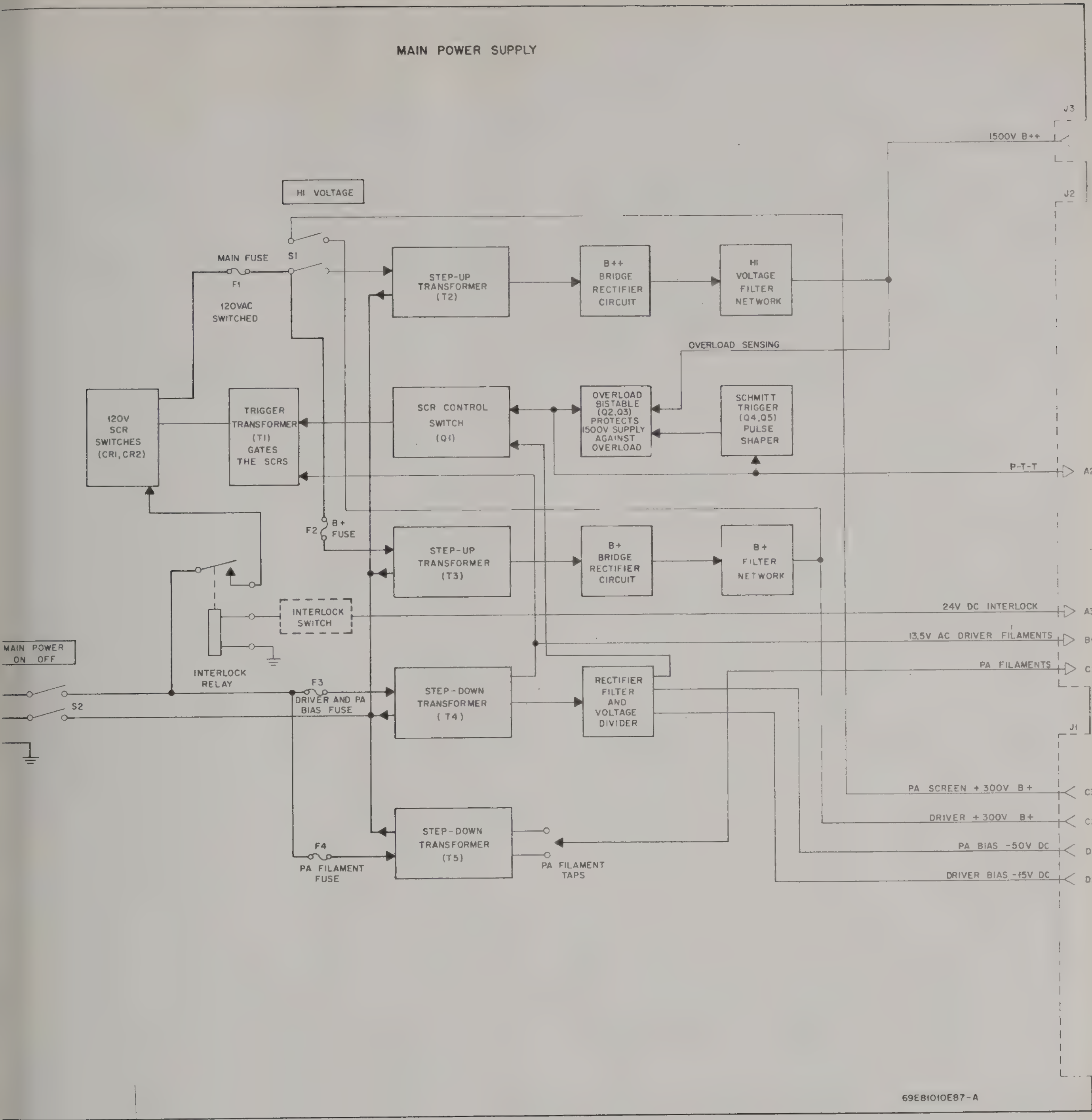


Figure 2.
Power Supply Functional Block Diagram

d. 300-Volt Circuit

With 120 volts ac from the SCR switching circuit applied to the primary of transformer T3, the secondary winding and its associated bridge rectifier and filter circuit supplies a +300-volt dc output for the exciter-driver and screen grid(s) of the power amplifier tube(s). The +300 volts dc to the exciter-driver can also be applied by leaving the HIGH VOLTAGE switch in the "OFF" position and keying the station (for tune-up of the exciter-driver tripler and power amplifier stages).

e. Keying Circuit

The overload protection circuit (Figure 3) protects the power amplifier against excessive plate current drain. This circuit consists of a bistable multivibrator circuit (Q2 and Q3) and a Schmitt trigger circuit (Q4 and Q5). When the transmitter is keyed, +12 V dc is applied (on the push-to-talk lead) to the bases of Q4 and Q1. The positive voltage at the base of Q4 causes its collector to drop from 10 volts to approximately 1 V dc. With Q4 conducting, forward bias is removed from the base causing Q5 to turn off, and the collector voltage rises to +12 volts. The output from the collector of Q5 is applied through a differentiating circuit (C5 and R12) to the base of Q3 via CR16, causing transistor Q3 to turn on. With transistor Q3 conducting, its collector voltage drops close to ground potential (0.2 V dc nominal). This removes the forward bias from transistor Q2, turning it off. The collector of Q2 will again begin to rise toward +10 V dc since the emitter-to-collector junction is no longer forward biased. Diode CR9 is reverse-biased and the input drive voltage forward biases the base of Q1 which completes the T1 primary path to gate the SCRs on. The circuit will remain in this state until the station is unkeyed or an overload condition occurs to change the state of the bistable multivibrator.

f. Overload Circuit

When the transmitter is keyed, plate current flows from ground through R19, R13, the high voltage rectifier, and the filter circuit to the plate circuit of the power amplifier. The more current drawn by the plate circuit, the more negative the junction of R19 and R13 becomes with respect to ground. This voltage is referenced to +12 volts dc through a divider network (R10 and R11). When the junction becomes slightly negative, CR15 and CR16 are forward biased. This permits current to flow through R12, causing a negative voltage to appear at the base of Q3 which cuts it off. When Q3 turns off, Q2 conducts, causing the

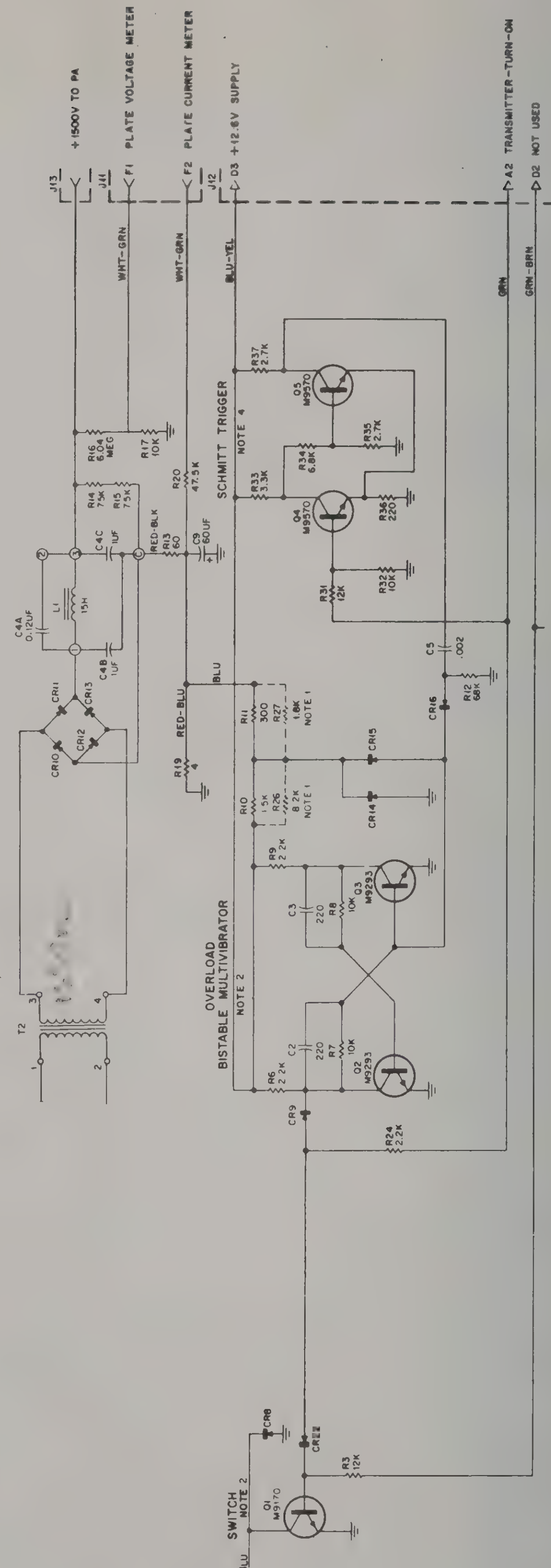


Figure 3.
High Voltage Keying and Overload Circuit

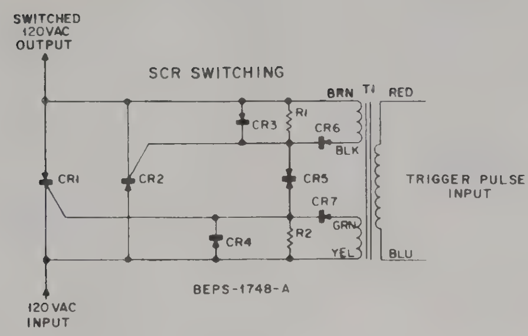


Figure 4.
SCR Switching Circuit

emitter-to-collector junction to appear as a very low impedance. This low impedance allows the input drive voltage (keying voltage) to forward bias CR9 which deprives Q1 of its drive. With no drive to Q1, the switching circuit is turned off, thereby turning off the high voltage supply.

Keying the transmitter again causes the overload protection circuit to be reset automatically, since the Schmitt trigger produces a pulse to turn Q3 on and Q2 off each time the station is keyed. If the transmitter is keyed before the overload condition is removed, the overload circuit will again turn off the high voltage supply. This circuit operates only when plate current becomes excessive. The operating point is fixed and can not be adjusted.

g. SCR Switching Circuit

The silicon controlled rectifier (SCR) is a solid-state switch which can be turned on with a momentary trigger pulse (control current) applied to the gate. Once gated the SCR will conduct until the anode voltage is removed or reverses as in the case of an ac voltage.

Figure 4 shows a typical SCR switch as used in the power supply circuit. The SCR switch is connected in a back-to-back configuration such that CR2 conducts when the ac sine wave is in the positive half cycle and CR1 conducts during the negative half cycle.

The trigger pulse for the SCRs is taken from the secondary windings of transformer T1. When a trigger pulse of 0.9 V or greater (gate to cathode) is applied to CR1 (or CR2), the SCR is biased into conduction, connecting the respective half cycle of the 117 V ac voltage to the primary of the high voltage transformer. Trigger pulses are generated for each half cycle of conduction.

The SCRs are mounted on individual heat sink assemblies and mounted on the back side of the front panel for additional heat dissipation.

3. TROUBLESHOOTING

a. 1500 V DC Bridge Circuit

The high voltage required for the power amplifier is provided by transformer T2 and the bridge rectifier circuit consisting of CR10, CR11, CR12, and CR13. To isolate a malfunction in this stage proceed as follows:

(1) Disconnect one lead from the primary and one lead from the secondary of transformer T2.

(2) Measure the resistance of the primary and secondary windings. A normal indication is 0.30 ohm across the primary and 25 ohms across the secondary.

(3) Disconnect one lead from each encapsulated silicon diode terminal and measure the front to back resistance ratio.

NOTE

These rectifiers consist of ten matched diode chips in each encapsulation and have a nominal forward voltage drop of approximately 5 volts at 25°C. Therefore, it is necessary to use an ohmmeter or diode checker with a supply voltage of 6 or more volts such as the Motorola Model T1009A or T1011A, or equivalent.

(4) Measure the resistance across filter choke L1. A normal reading is 100 ohms.

(5) Check filter capacitors C4A, C4B, and C4C for shorts.

(6) Check the voltage divider network and load resistances R13, R14, R15, R16, R17, R19 and R20. Compare the measured values with those on the schematic diagram.

(7) Reconnect all leads disconnected above.

b. 300 V DC Bridge Circuit

This circuit provides B+ for the exciter-driver stage and the power amplifier screen grids. Disconnect one lead from the secondary winding of transformer T3 and remove fuse F2 from its holder.

(1) Measure the primary resistance of transformer T3. A normal indication is 5.3 ohms.

(2) Measure the secondary resistance. A normal indication is 45 ohms.

(3) Measure the front-to-back ratios of diodes CR17, CR18, CR19 and CR20. The normal ratio is more than 10-to-1.

(4) Measure the resistance across filter choke L2. A normal reading is 70 ohms.

(5) Check capacitors C6A and C6B for short circuits to ground. A leaky capacitor can be detected by direct substitution with a known good one.

c. Exciter Filament and Exciter-PA Bias Supply Circuits

A failure occurring in these circuits can cause three separate malfunctions: (1) absence of 13.5 V ac to the primary circuit of the SCR control transformer T1, (2) absence of exciter filament voltage, (3) absence or incorrect bias supply to the power amplifier and exciter-driver stages.

To locate a defect in these circuits, proceed as follows:

(1) Remove fuse F3 from its holder.

(2) Disconnect the GRN-YEL and the RED leads from the secondary of transformer T4.

(3) Measure the resistance of the primary windings of transformer T4. A normal reading is 20 ohms.

(4) Measure the resistance of the RED, RED-YEL secondary winding. A normal reading is 8.6 ohms.

(5) Measure the resistance of the GRN, GRN-YEL secondary winding. A normal reading is 0.85 ohm.

(6) Check C8A and C8B for short circuits to ground. A leaky capacitor can be detected by direct substitution with a known good one.

(7) Check diode CR21 for a short or open circuit.

d. Switching Circuit Malfunction

(1) General

Proficiency in troubleshooting and service of solid-state switching circuits requires a knowledge of the basic functions of transistor switching circuits, their use, and the states of operation. The following guides should be helpful in locating switching circuit malfunctions.

-- Determine normal transistor state and biasing (cut-off, saturated) before attempting to interpret the measured data.

-- Determine the conditions which trigger the switch and number of inputs used.

-- Determine the polarity of the input signal.

-- Determine type of switch used.

-- Understand the circuit and then determine the malfunction through voltage and resistance checks.

(2) Switching Transistor Stage Malfunction

The switching transistor (Q1) provides a ground path for the primary circuit of control

ransformer (T1) to gate the SCRs. Take voltage readings and compare them with those as shown on the schematic diagram.

(3) SCR Circuit Malfunction

CAUTION
Use an isolated meter to take voltage readings in this circuit.

The function of the SCRs is to turn on the high voltage circuits (300 V dc, and 1500 V dc) to the exciter-driver and final amplifier stages when their gates are keyed by control transformer T1. Measure the gate-to-cathode voltages on both CR1 and CR2. The readings obtained should be greater than 0.9 V ac.

(4) Schmitt Trigger Circuit Malfunction

The function of the Schmitt trigger circuit is to set the overload multivibrator and to assure it to be reset when an overload condition occurs. Take voltage readings and compare with those shown on the schematic diagram.

(5) Bistable Multivibrator Circuit Malfunction

The function of the bistable multivibrator circuit is to turn off switching transistor Q1 when an overload condition exists. Refer to the schematic diagram for proper operating voltages in the bistable circuit.

4. REMOVAL AND INSTALLATION OF ASSEMBLIES

a. General

The following paragraphs describe procedures for installation and removal of various assemblies. Observe standard servicing practices such as tagging of leads and identification of connecting points.

WARNING
High voltages are present in this chassis. Follow all safety precautions.

b. Control Board Removal

(1) Turn the MAIN power switch to the OFF position.

(2) Disconnect the ac line cord.

(3) Remove the two power supply hold down screws and swing open the chassis.

(4) Loosen the mounting screw at the top of the printed circuit board.

(5) Move the board slightly to the right, pull forward and lift up. The board may now be serviced from either side.

(6) When replacing this board, reverse this procedure.

c. Interlock Relay Removal

(1) Turn the MAIN power switch to the OFF position.

(2) Disconnect the ac line cord.

(3) Remove the two power supply hold down screws and swing open the chassis.

(4) Remove the relay cover by loosening the cover mounting screw.

(5) Unsolder the YEL-BLK, BLK-RED, GRAY-RED and BLK wires from the relay lugs.

(6) To free the relay, remove the mounting screw from the opposite side of the chassis.

(7) When replacing this relay, reverse this procedure.

d. Main Power Switch Removal

(1) Turn the MAIN power switch to the OFF position.

(2) Disconnect the ac line cord.

(3) Remove the mounting nut from the front panel of the power supply.

(4) From the rear of the station, pull the switch from the panel and remove the four lugged wires.

(5) When replacing the switch, reverse this procedure.

e. Power Supply Chassis Removal

(1) Turn the MAIN power switch to the OFF position.

(2) Disconnect the ac line cord.

(3) Unplug the main cable harness (two plugs) from the back of the power supply.

NOTE

If servicing is to be done at the station, skip to step (10). If servicing is to be done away from the station continue with step (4).

(4) Remove the six mounting screws on the left side of the junction box (at the bottom of the cabinet), remove the cover and place it in front of the station.

(5) Remove the three screws in the bottom of the smaller junction box compartment.

NOTE

One screw also holds down a lug on a green wire. Be sure this is replaced when reassembled.

(6) Loosen the two screws on the right side of the junction box, lift the left side of the cover up, slide it to the left and lift out.

(7) Remove the three lugged wires (BLK, GRN, WHT) from the cover.

(8) Pull the ac cable out of the hole in the back of the junction box.

(9) Disconnect the high voltage lead from the power supply.

(10) Remove the eight mounting screws holding the power supply panel to the mounting rack.

WARNING

This power supply weighs approximately 130 pounds.

(11) Slide the power supply forward and place face down in front of cabinet.

(12) When replacing the power supply, reverse this procedure.

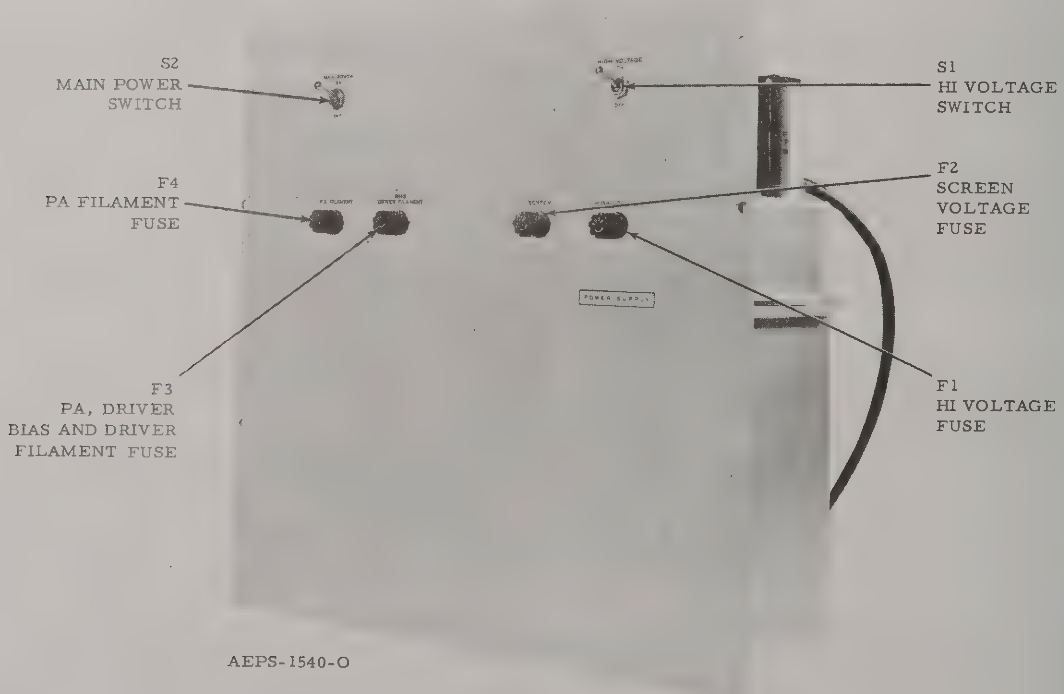
f. Silicon Controlled Rectifier (SCR) Heat Sink Removal

(1) Remove the two nuts and washers holding the heat sink assembly to the power supply chassis.

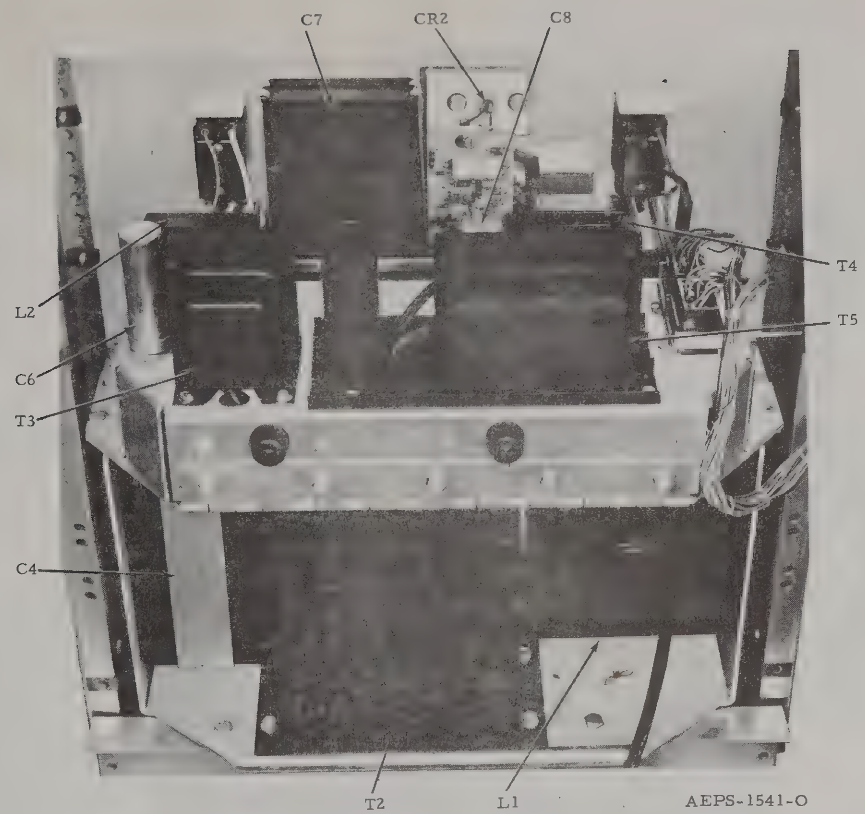
(2) Disassemble the heat sink assembly as shown in the SCR heat sink detail.

(3) Before replacing this unit, apply silicone grease (Motorola Part Number 11T834678) to both sides of the mica insulator.

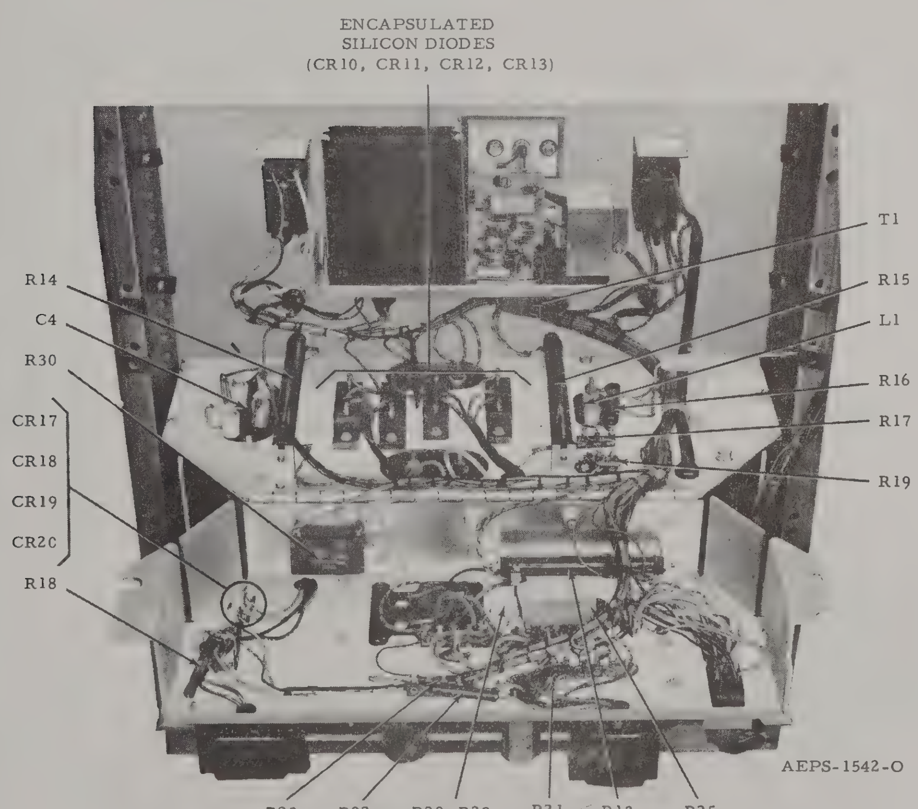
5. SERVICE AIDS



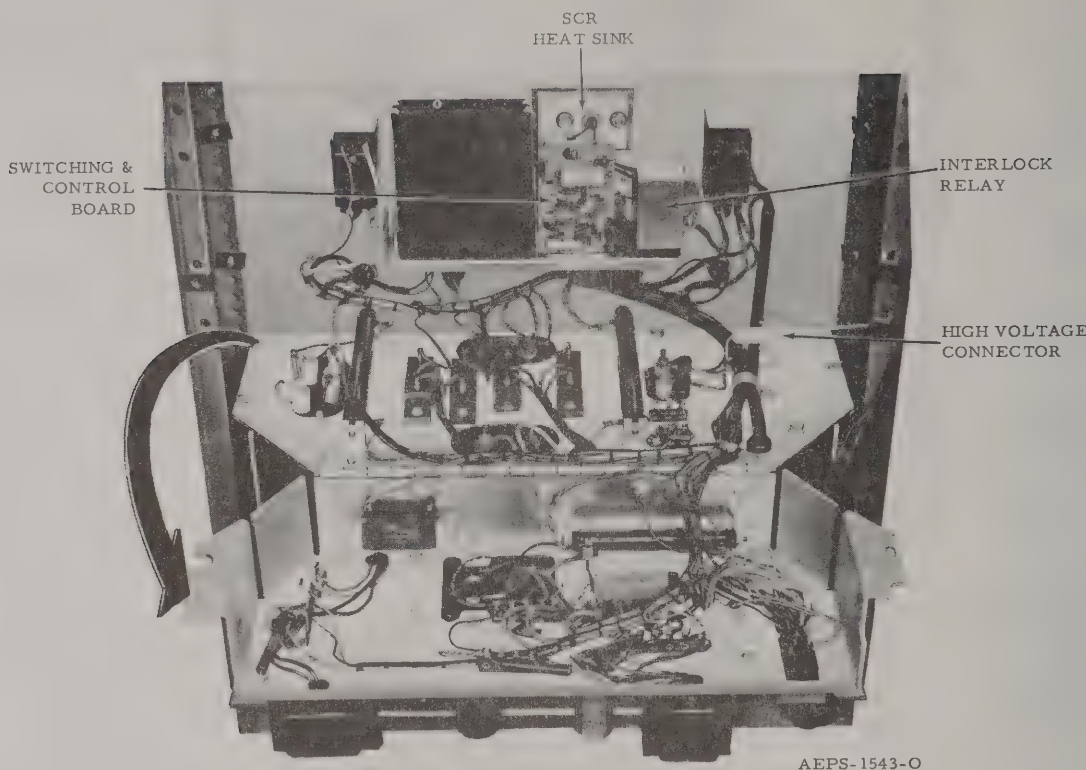
Parts Location Detail (Front View)



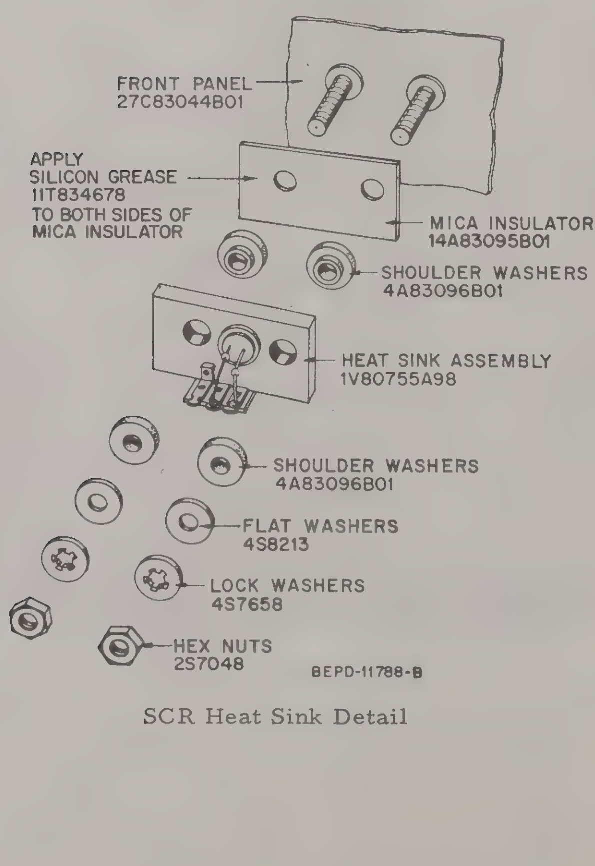
Parts Location Detail (Rear View)



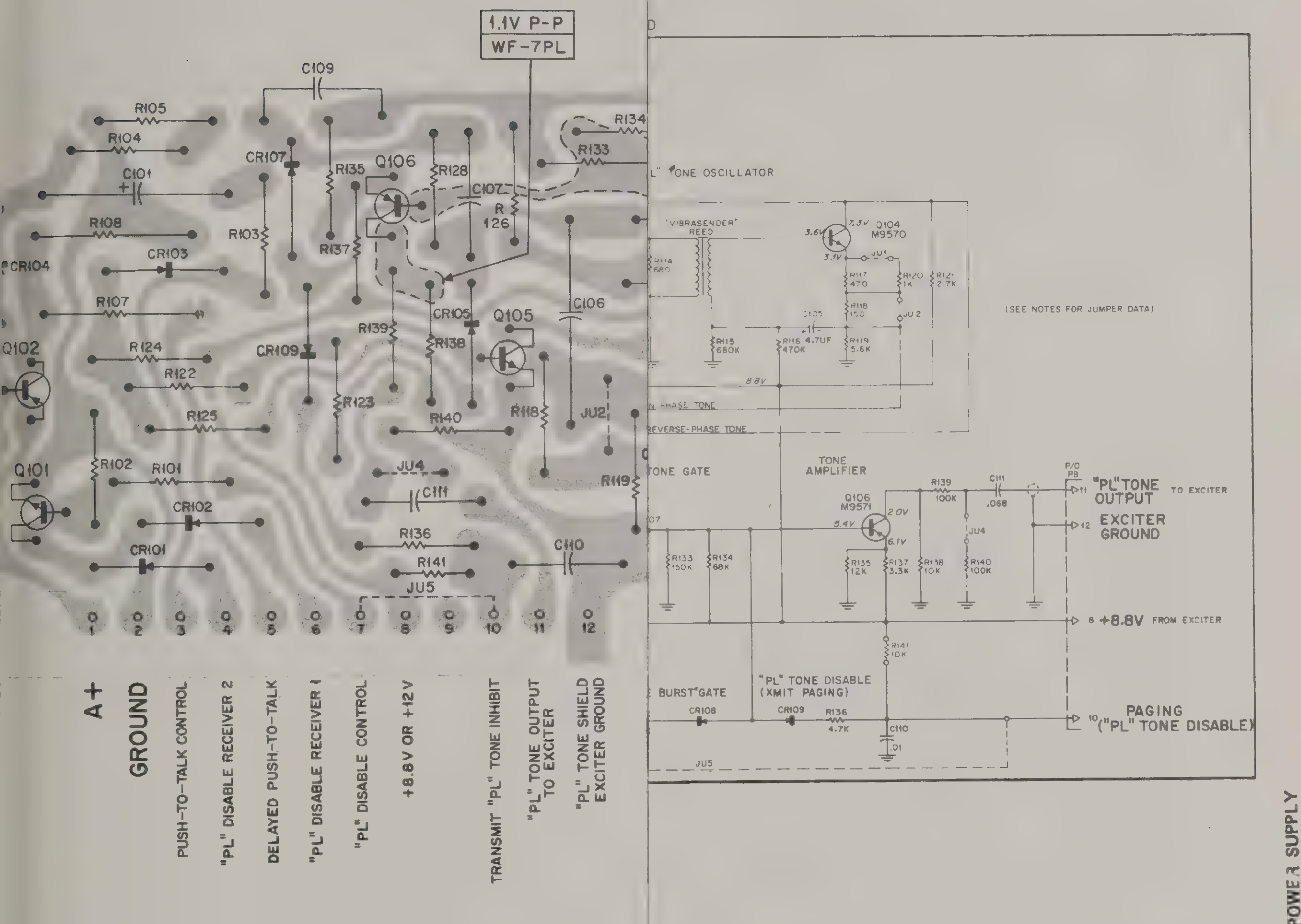
Parts Location Detail (View from Wiring Side)



Miscellaneous Parts Location Detail

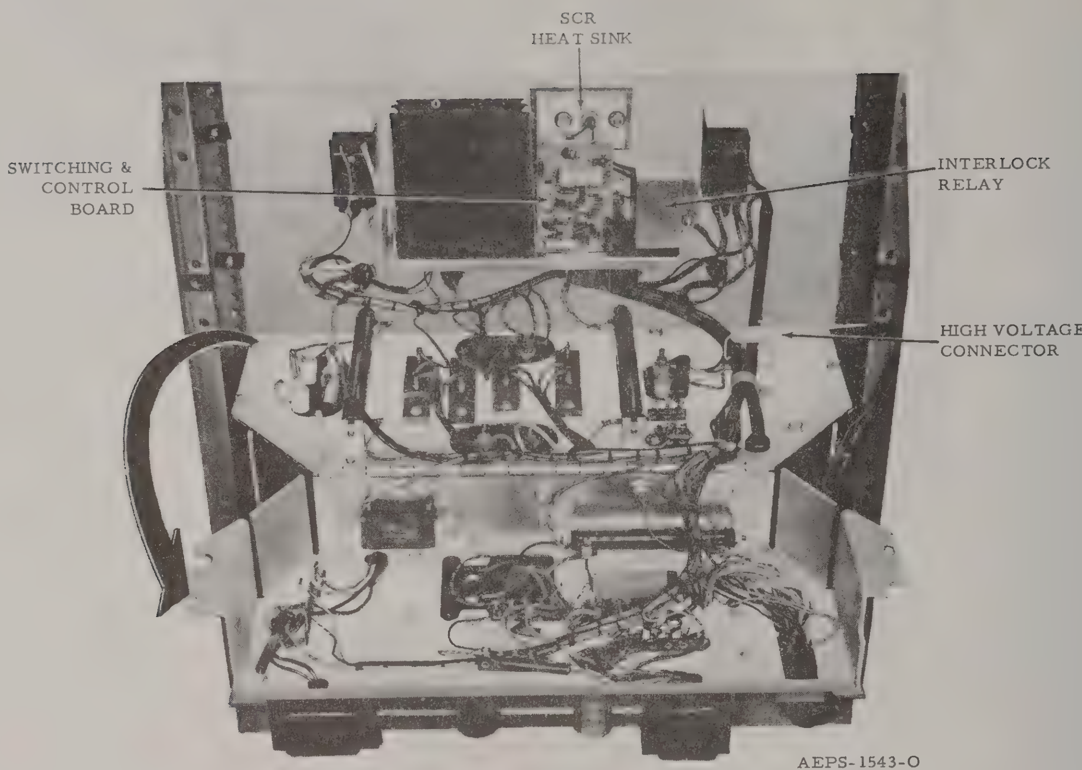


SCR Heat Sink Detail

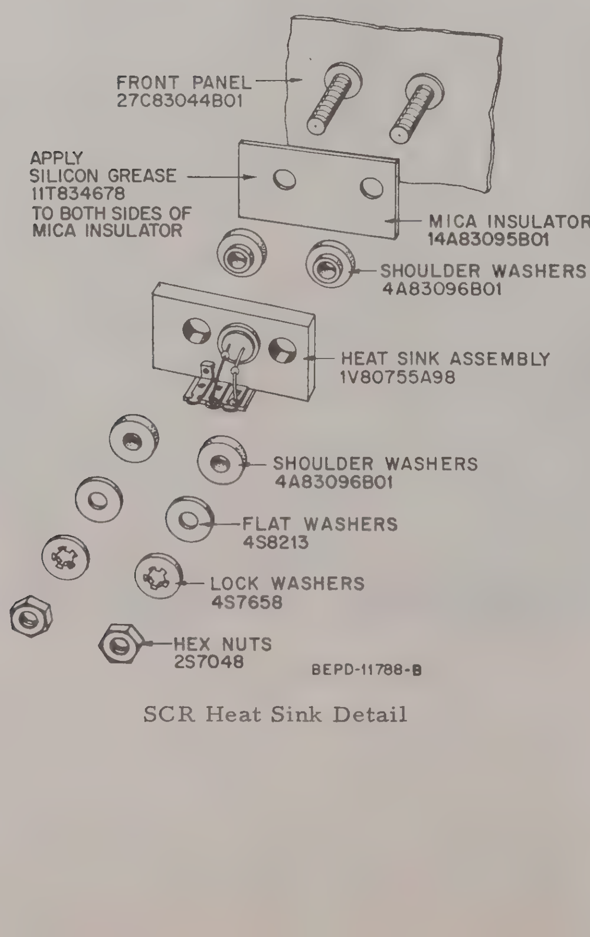


PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

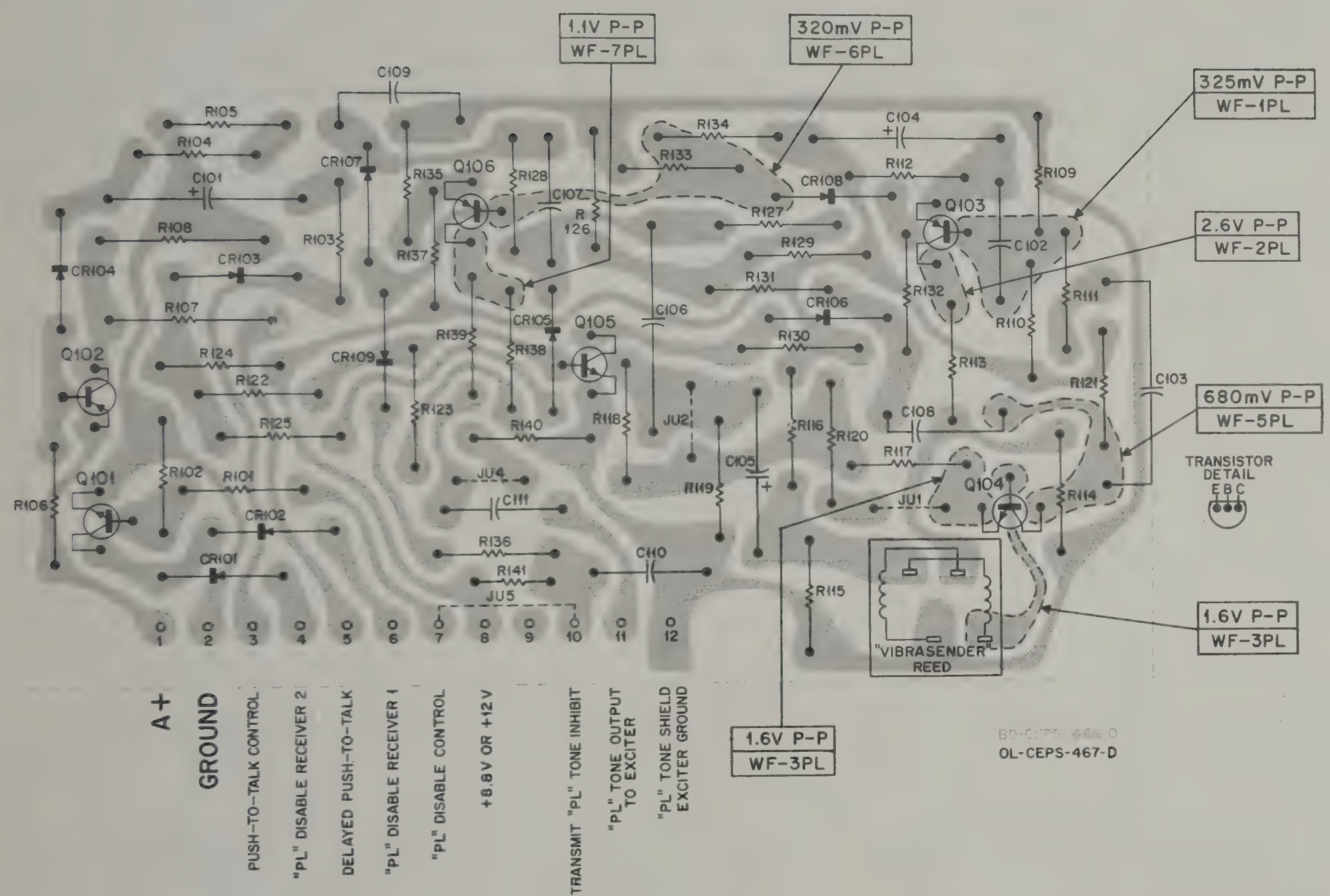
TLN8847A-1 "Private-Line" Oscillator & Delay (Encoder) Circuit Board Detail
Motorola No. PEPS-469-C
9/1/71-UP

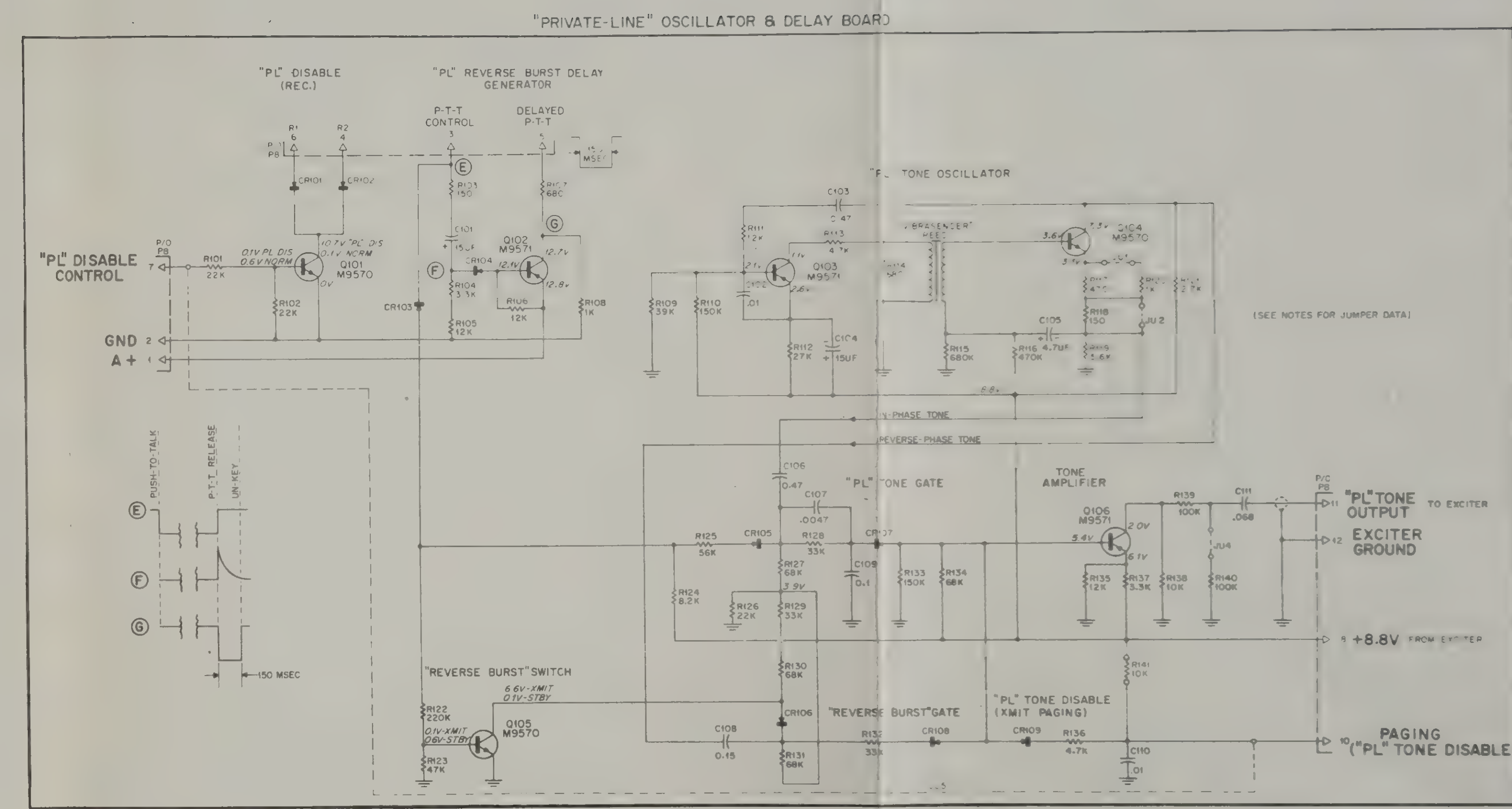


Miscellaneous Parts Location Detail



SCR Heat Sink Detail





POWER SUPPLY

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN8847A-1 "Private-Line" Oscillator & Delay (Encoder) Circuit Board Detail
Motorola No. PEPS-469-C
9/1/71-UP

TONE REMOTE CONTROL PACKAGE

FOR

TONE REMOTE CONTROL

BASE AND REPEATER STATIONS

450/470 MHz 250/275 W RF POWER

CONTENTS OF PACKAGE

PARTS LIST

TLN8847A "Private-Line"
Oscillator & Delay Board

PL-293-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; 50 v; unl stated
C101	23D82783B24	15 ±10%; 25 v
C102, 110	8D82905G01	.01 ±10%
C103, 106	8D82905G33	0.47 ±20%
C104	23K865136	15 ±20%; 25 v
C105	23K865137	4.7 ±10%; 25 v
C107	8D82905G26	.0047 ±10%; 100 v
C108	8D82905G05	0.15 ±10%
C109	8D82905G07	0.1 ±10%
C111	8D82905G04	.068 ±10%
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101 thru 109	48C82392B03	silicon
		TRANSISTOR: (SEE NOTE)
Q101, 104, 105	48R869570	N-P-N; type M9570
Q102, 103, 106	48R869571	P-N-P; type M9571
		RESISTOR, fixed; ±5%; 1/4 w; unl stated
R101, 102	6S128685	22K ±10%
R103	6S129862	150 ±10%
R104, 137	6S124A60	3.3K
R105, 106, 111, 135	6S129887	12K
R107	6S129984	680
R108	6S6411	1K; 1/2 w
R109	6S129777	39K
R110, 133	6S128683	47K ±10%
R112	6S129886	27K
R113, 136	6S129669	4.7K
R114	6S5651	680; 1/2 w
R115	6S131857	680K
R116	6S129149	470K
R117	6S129709	470
R118	6S131276	150
R119	6S129982	5.6K
R120	6S129805	1K
R121	6S129707	2.7K
R122	6S129147	220K ±10%
R123	6S128902	47K ±10%
R124	6S128686	8.2K ±10%
R125	6S128684	56K
R126	6S129667	22K
R127, 130, 131, 134	6S129299	68K
R128, 129, 132	6S129526	33K
R138, 141	6S129668	10K
R139, 140	6S124A97	100K

NOTE:

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

TONE REMOTE CONTROL PACKAGE

FOR

TONE REMOTE CONTROL

BASE AND REPEATER STATIONS

450/470 MHz 250/275 W RF POWER

CONTENTS OF PACKAGE

TONE REMOTE CONTROL CHASSIS

MODEL TCN1094A

STANDARD FUNCTION TONE FREQUENCIES

FREQ.	FUNCTION	NOTES
2050	"Private-Line" Disable	
1950	Transmit F1	
1850	Transmit F2	
1750	R2 Mute or (Receive F1)*	
1650	R2 Unmute or (Receive F2)*	
1550	"MAX" SQUELCH or REPEATER "OFF" or "PL" ON	
1450	"MIN" SQUELCH or REPEATER "ON" or "PL" OFF	
1350	"Wild Card" I ON	
1250	"Wild Card" I OFF	
1150	"Wild Card" II ON	
1050	"Wild Card" II OFF	

*C2-R2 Receiver Frequency Selection

1. APPLICATION

a. Line Tones

This chassis, together with the associated plug-in modules, permits control of the station from a remote location. Audio-frequency tones generated at the remote control point are carried over wire lines to the station. This chassis and the associated plug-in modules convert the various tones into corresponding switching functions such as transmitter keying, frequency selection, and "Private-Line" disabling.

b. Types of Modules

The basic remote control chassis is used in both repeaters and base station applications. Solid-state plug-in modules are used. All base stations are equipped with the following modules -- Guard Tone Decoder, Station Logic, F1 Decoder, and Line Driver. Repeater stations are also equipped wtih a Squelch Gate and Time-Out Timer Module. Space is provided for additional optional accessory modules.

(1) Station Logic Module

This module provides sequencing, timing and control functions for remote operation of the station. It also amplifies line audio to the proper level for the exciter. The following switches and controls are found on this module:

- XCTR level -- sets audio input to exciter.
- R1 LINE OUTPUT -- sets receiver #1 line output level.
- R1 SQU Control -- controls receiver #1 squelch sensitivity setting.
- LINE/XCTR AUDIO Switch -- selects exciter or line audio level measurement at the metering socket.
- METER SCKT -- permits the serviceman to connect a Motorola Portable Test Set for servicing remote control unit logic malfunctions.

(2) Guard Tone Decoder Module

This decoder supplies a push-to-talk voltage when a 2175 Hz guard tone is received over the control line from the associated remote control point. In addition, the decoder amplifies received control tones and distributes them to other decoders through the remote control chassis circuit board.

(3) Squelch Gate Module

The squelch gate is used for keying the transmitter in repeater applications. It accomplishes this by monitoring the receiver quieting level, and when the noise drops below the threshold value, it provides an output for keying the

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transmitter. (In "Private-Line" tone-coded squelch stations, it also requires a PL tone.) The threshold level is adjustable to permit transmitter keying at approximately 10 to 25 dB receiver queiting. The following controls are found on this module:

LOGIC CIRCUITS METERING TABLE

SET-UP PROCEDURE

1. Function switch to XMTR position on Portable Test Set.
2. Oscillator switch to METER REV position on Portable Test Set.
3. Audio switch to XCTR position on Station Logic Module.

PORTABLE TEST SET SWITCH POSITION	CIRCUIT METERED	TYPICAL READING STANDBY	TYPICAL READING TRANSMIT
1	Line P-T-T	25 uA (min)	0
2	Redundancy	25 uA (min)	25 uA (min)
3	Switched A+	0	25 uA (min)
5	Antenna Relay Switch, Receiver Mute, Line Driver Disable	25 uA (min)	0
6	PL Disable	20 uA (min)	0
11	Line Audio	*0.34 V ac	N/A
	Exciter Audio	N/A	Per Exciter Sensitivity Label

*Meter reading is for PL disable condition rather than transmit condition.

**Dependent upon audio levels used at the individual station. Refer to the INSTALLATION AND INITIAL ADJUSTMENT section of the manual for set-up instructions and typical readings.

● REPEATER SQUELCH KIT -- used to adjust the noise input from the receiver discriminator to the desired threshold level.

● REPEATER LEVEL -- used to adjust the receiver audio level to match the line audio level, and is in the circuit only during repeater operation.

(4) Time-Out Timer Module

The Time-Out Timer Module is used to limit transmission time. In base station applications, it limits the continuous transmission time, while in repeater applications, it limits the transmission times of individual users but not the period of continuous transmission that would occur if it was keyed during the turn-off delay. The unit can be preset for 1/2, 1, 2, 4, or 8 minutes operation.

(5) F1 Decoder Module

This module provides a switched ground to the transmitter channel element when it detects a 1950 Hz tone, and provides PL disabling of the receiver when it detects a 2050 Hz tone (in PL stations only).

(6) Line Driver Module

This module amplifies and routes the received audio to the remote control point and couples the audio from the remote control point to the transmitter. The following controls are found on this module.

● INTERCOM Switch -- permits intercom operation between the station site and remote control point(s).

● LOCAL SPKR LEVEL control -- permits adjustment of audio level for local speaker monitoring.

(7) F2 Control Module

This module provides a switched ground to the transmitter F2 channel element when it detects an 1850 Hz tone.

(8) C2-R2 Control Module

On stations with two-frequency transmitters and receivers, this module provides switched ground to the transmitter F2 channel element when it detects an 1850 Hz tone, receiver F1 channel element when it detects a 1750 Hz tone, and receiver F2 channel element when it detects a 1650 Hz tone.

c. Optional Modules

The options decoder slot in the remote control chassis will accept one of the following modules -- Repeater Control, PL Control or Squelch Control. Additional modules that may be added are Time-Out Timer, 4-Wire Audio, Single-Tone Decoder, and "Wild Card" Control. The F2-R2 Mute Module can be used instead of an F2 Control Module.

(1) Time-Out Timer

The time-out timer is standard in the repeater models, and may be added to the base stations as an option. As in the repeater, it is used to limit the length of any single transmission to a preset period of 1/2, 1, 2, 4, or 8 minutes.

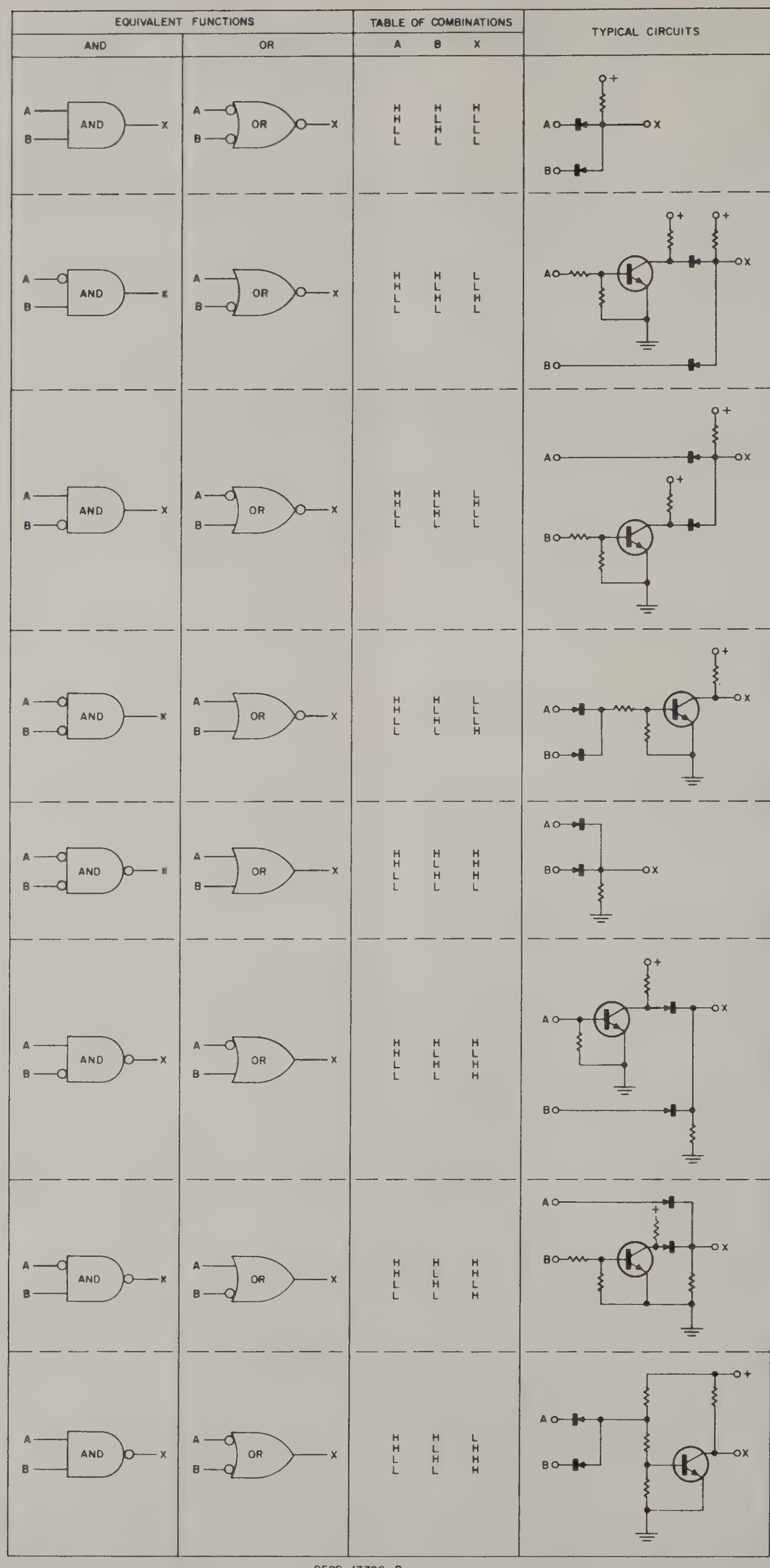


Figure 1.
Chart of Typical AND and OR Logic Presentations and Typical Equivalent Circuit Diagrams

(2) Four-Wire Audio Option

When the station is equipped for 4-wire dio operation (i.e., two line driver modules), o separate audio pairs can be used. A variety operational options are available, depending on the jumpers used and the connection of the nes to the station. Refer to the line driver odule section in this manual for jumpering formation.

(3) Single-Tone Decoder

The single-tone decoder module requires at the incoming rf signal be initially modulated th a tone burst of a specific frequency for lective signalling.

(4) Repeater Control Module

This module provides tone control for peater (RT) turn-on and turn-off, thereby offering eration as a base station or repeater.

(5) PL Control Module

This module provides tone selection of 'rivate-Line" tone-coded squelch or carrier uelch operation, and does not reset when the ansmitter is keyed.

(6) "Wild Card" Control Module

This module contains four tone sensitive rcuits for operating distant functions through vitched transistor outputs or in conjunction with tional relay kits for heavier current switching quirements. Refer to the "Wild Card" Control odule section for additional information.

(7) Paging Decoder Module (Single-Frequency Stations Only)

This module provides transmitter "Pri-te-Line" tone-coded squelch inhibiting when rrier squelch receiver paging is desired. Refer the Paging Decoder Module section for additional formation.

(8) Squelch Control Module

This module selects threshold or maxi-um squelch level as desired. Refer to the uelch Control Module section for additional formation.

(9) F2-R2 Mute Module

This module controls the line level and uelch for a second receiver. It also controls equency selection and receiver unmuting func-ons. Refer to the F2-R2 Mute Module section r additional information.

2. DESCRIPTION

The remote control chassis mounts plug-in modules that perform switching functions for station operation. It also includes a local control panel.

Nylon guide rails snapped into plate in this chassis align the modules to mate with connecting pins on the interconnect circuit board at the rear of the chassis.

The local control panel provides the following local control facilities for service and maintenance.

- XMIT Switch -- for local keying of the transmitter.
- "PL" DISABLE Switch -- disables receiver "Private-Line" tone-coded squelch operation.
- LINE DISABLE Switch -- disables the tone control input circuits to prevent remote operation of the transmitter.
- LOCAL MIKE -- allows the use of a local microphone for transmitter service and maintenance.

3. BASIC CIRCUITS

Several basic circuits are used extensively in the logic circuitry of the remote control unit. The AND gate, the OR gate, the transistor switch, the Schmitt trigger and the bistable multivibrator are the most common. These circuits are described in the following paragraphs.

a. AND and OR Logic

An AND gate has two or more inputs and a single output. All inputs (A and B and C and etc.) must be in the "active" state before the output will be switched from the "inactive" to the "active" state.

An OR gate also has two or more inputs and a single output. Any input (A or B or C or etc.) which is in the "active" state will switch the output from the "inactive" to the "active" state.

Binary logic circuits have two states which are designated "active" and "inactive". Each of these states may be either of two distinct voltage levels. These voltage levels are designated "high" and "low". The more positive voltage source is considered to be the "high" level and the less positive voltage source is considered to be the "low" level. The "high" and "low" levels are represented by the letters "H" and "L" in the logic truth table. Logic symbols for AND and OR gates show the "high" and "low" voltage levels as follows: A small circle at the input to a gate indicates that

the "low" level activates the function. Conversely, the absence of a small circle indicates that the "high" level activates the function. The same is true of the output. A small circle at the output indicates that the "low" level is present when the function is activated and absence of the circle indicates that the "high" level is present when the function is activated.

For example, the first AND gate shown in Figure 1 requires two "high" inputs before the output will be a "high". In all other input conditions, the AND gate will be "inactive" and the output will be "low". In the first OR gate, input A or input B is in the "active" condition when the voltage level is "low". When either of the inputs is "low", the output will also be "low" (active state).

b. Transistor Switches

A switch is characterized by a high resistance in one state and a low resistance in another. Transistors operate as switches if they are operated under nonconducting (cut off) conditions where the resistance of the emitter to collector junction is very high or full saturation conditions where the resistance of the emitter to collector junction is very low. Figure 2 shows the configuration of typical transistor switches.

The transistor switches used in the remote control unit are connected in either the common emitter or common collector configuration. In the common emitter configuration, an inverted output is obtained. With no input signal, there is no forward bias on the transistor, the transistor is cut off and the collector voltage approaches the supply voltage.

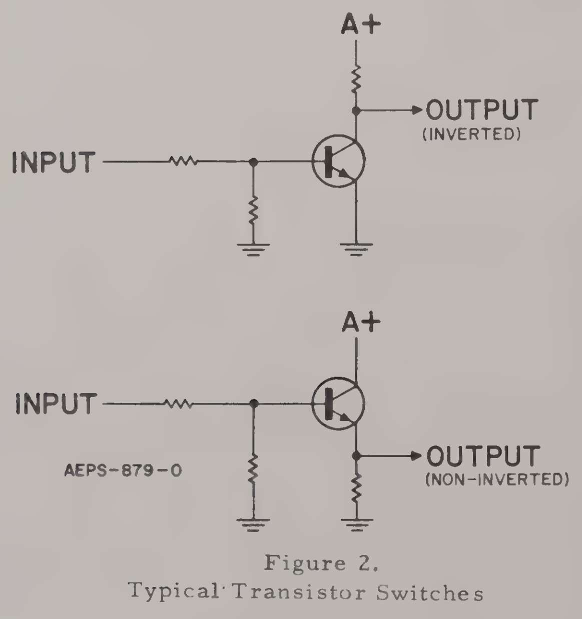


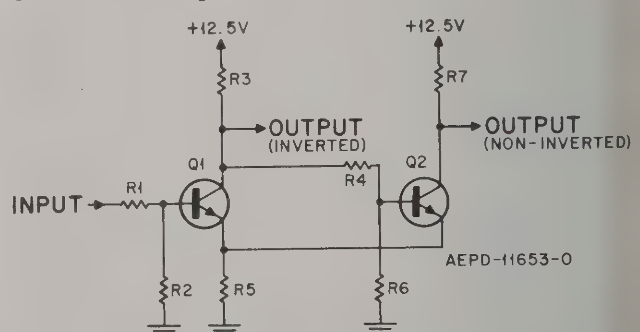
Figure 2.
Typical Transistor Switches

When an input signal drives the base positive, the transistor is forward biased and starts to conduct. In full saturation, the collector voltage approaches the emitter voltage which is at ground potential.

A non-inverted output is obtained when the transistor is connected in the common collector configuration. With no input signal, the transistor is cut off and the emitter is at ground potential. When a positive input voltage is applied, the transistor is forward biased and the emitter voltage follows the base voltage until the collector voltage (supply voltage) is approached. A large power gain can be obtained from the common collector circuit, however, the voltage gain is always less than one.

c. Schmitt Trigger

A Schmitt trigger is a regenerative bistable circuit whose state depends on the amplitude of the input voltage and where feedback is provided by the use of a common emitter resistor. Figure 3 shows the configuration of a typical Schmitt trigger circuit. The output of the Schmitt trigger will be one value if the input exceeds a given level and the output will return to its initial value if the input goes below another level. The circuit is used for detecting a dc level and providing a fast rise square wave output.



NOTE:
1. THE REFERENCE NUMBERS SHOWN DO NOT CORRESPOND TO THOSE ON THE SCHEMATIC OR THE PARTS LIST.

Figure 3.
Typical Schmitt Trigger

In the initial state, Q1 is biased at cut off and Q2 is biased into conduction. The common emitter voltage is a function of the voltage divider formed by R5 and R7.

When the input drives the base of Q1 positive, Q1 starts to conduct. Its collector voltage drops and this voltage is coupled through R4 to the base of Q2, turning it off. With Q2 in the off state, its collector voltage rises abruptly from its original low level. The common emitter voltage is now a function of the voltage divider formed by R5 and R3.

To return the Schmitt trigger circuit to its original state, the input voltage must drop to a level which no longer forward biases the base of Q1. The output of a Schmitt trigger may be taken at the collector of either Q1 or Q2. The output at the collector of Q1 will be inverted while the output at the collector of Q2 will be non-inverted.

d. Bistable Multivibrator

The bistable multivibrator is a double input switching circuit whose state is determined by the input applied and where feedback is used to maintain a given state. Figure 4 shows the configuration of a typical bistable multivibrator circuit.

NOTE:
1. THE REFERENCE NUMBERS SHOWN DO NOT CORRESPOND TO THOSE ON THE SCHEMATIC OR PARTS LIST.

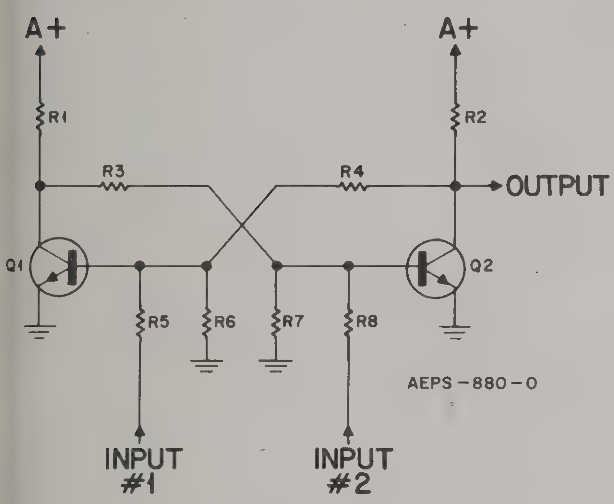


Figure 4.
Typical Bistable Multivibrator

Due to normal variations in the multivibrator circuit, one transistor will saturate and the other will be cut off upon initial application of dc power. Each transistor is held in its particular state by the condition of the other.

Assume that Q1 begins conducting first when power is applied. The collector voltage of Q1 will attempt to approach the emitter voltage (ground). This voltage is coupled to the base of Q2 through R3, preventing Q2 from conducting. When Q2 is cut off, the collector voltage attempts to rise to the supply voltage. This voltage is coupled through R4 to the base of Q1, driving it further into conduction which, in turn, lowers the voltage being coupled to the base of Q2 even more. This sequence continues until one transistor is saturated and the other is cut off.

The inputs are positive voltage signals applied to the bases of the bistable circuit. A positive voltage applied to input #2 forces transistor Q2 to conduct. As Q2 conducts, the collector voltage begins to decrease. This decrease in voltage appears at the base of Q1, cutting it off. When Q1 stops conducting, the collector voltage attempts to rise to the supply voltage. This voltage is then coupled through R3 to the base of Q2, driving it further into conduction.

The desired output of the bistable multivibrator circuit may be selected by applying a positive voltage to the appropriate input. If a positive voltage is applied to input #1, the output will approach the level of the collector supply voltage of Q2. If a positive voltage is applied to input #2, the output will approach zero volts. An output may also be taken from the collector of Q1. This will be inverted from the Q2 collector output.

4. THEORY OF OPERATION

a. Tone Remote Control System

The tone remote control console is basically a two-tone sequential system with a time base. The first tone burst of any command is the guard tone. The guard tone is always 2175 Hz. Its purpose is to seize control of the station(s), mute the receiver(s) to eliminate any signals or noise from the phone lines, and generate a short "acceptance time" for the function detector(s). The second tone burst is a function tone. It varies in frequency, according to function, from 650 Hz to 2050 Hz with 100 Hz spacing. The purpose of the function tone is to tell the station what to do; i.e., transmit F1 or F2, PL disable, etc.

There are two types of commands in the tone system. The first is for any function except transmit. The second is for an actual transmitting function.

(1) Non-Transmit Command

The sequence of events for a non-transmit command follows (see Figure 5).

(a) Button is pushed at the console (time = 0).

(b) The guard tone decoder at the station mutes the receiver, applies P-T-T (not channel element drive), and starts function decoder acceptance time.

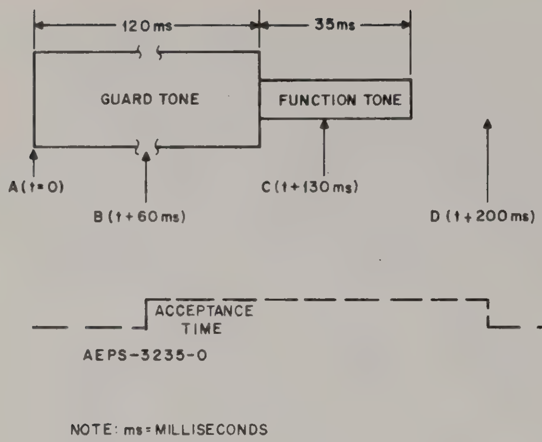


Figure 5.
Non-Transmit Command

(c) The proper function decoder is activated and a bistable multivibrator is "flipped" to store the command.

(d) P-T-T is removed at the station and the acceptance time is over for the function decoders. The station is now ready to accept another command.

(2) Transmit Command

The sequence of events for a transmit command follows (see Figure 6).

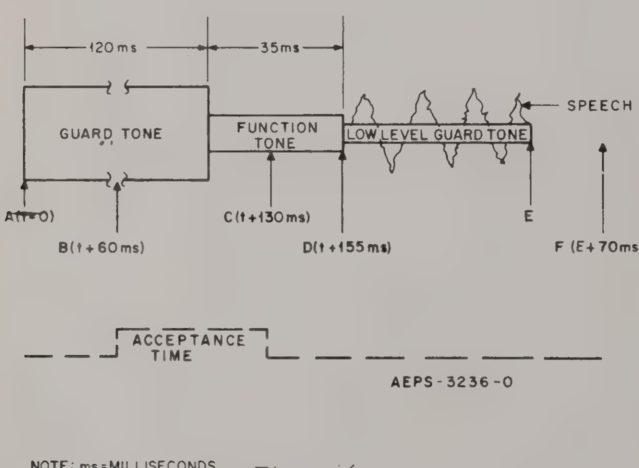


Figure 6.
Transmit Command

(a) Press P-T-T at the console (time = 0).

(b) P-T-T and acceptance time start at the station.

(c) Channel element is activated (full rf out). The acceptance time is aborted by the transmit function decoder to prevent speech falsing of any other function decoders.

(d) The low level guard tone (30 dB below speech) and speech are sent to the station. The guard tone maintains P-T-T during transmission. The guard tone is notched out of the modulation path.

(e) P-T-T is released at the console. The guard tone and speech are removed.

(f) P-T-T is released at the station and a new command may be accepted.

The basic difference between the transmit and non-transmit type functions, other than the different function tone frequencies, is the application of a low-level guard tone. Loss of this tone will result in transmitter turn-off and the resetting of multiple frequency stations to a neutral condition (with respect to transmit frequency selection). The next transmit command will set the station frequency to whatever its particular function tone indicates. This means that status indicators or read-outs are not required by parallel consoles or desk sets in large systems.

b. Non-Transmit Tone Commands

When a non-transmit tone command is initiated, such as PL monitoring a receive channel, muting or unmuting a second receive or the like, a ground is applied to the trigger input of the guard tone timer, causing a burst of high-level guard tone at 2175 Hz and at a level equal to voice peaks for not less than 100 milliseconds. When the guard tone timer shuts off it triggers the function tone timer to send 40 milliseconds of the function tone appropriate for the command. After the complete interval of function tone has been sent, the unit reverts to its normal state of receive operation. The function tone level is 10 dB below that of the guard tone.

While the command tones are being sent, the Line Driver Amplifier is on, and the Compression Amplifier is turned off to prevent any voice signal from mixing with the tones which would distort them.

c. Transmit Tone Commands

When a transmit command is initiated, the circuit functions as described for non-transmit tone commands, except that the function tone is followed by a low-level guard tone (30 dB below voice peaks) for the duration of the transmission.

and a ground is applied to the push-to-talk circuitry. The P-T-T ground turns off the Transmit-Receive Switch, muting the receiver path and enabling the transmit path.

5. SERVICE AND MAINTENANCE

NOTE

Specialized maintenance procedures for individual modules are described in the respective module sections in this manual.

a. Removal and Replacement of Modules

Modules may be removed by simply pulling outward on the module, and may be replaced by pushing the module into its position in the panel. The modules are labelled and the mounting positions are marked on the interconnect board at the inside rear of the module housing.

CAUTION

1. Never attempt to plug a module into the pins on the back of the remote control unit.
2. Always be sure of the correct module position before plugging in a module.
3. There are keying plugs in some modules to prevent insertion in the wrong position. Do not remove these plugs from the modules except when using the servicing kit.
4. Remove power to the station before inserting or removing modules to prevent damage to transistors by transients.

Technicians who service many of these stations may wish to carry spares and replace malfunctioning modules for immediate restoration of operation. The module may then be repaired at the shop and used as the next replacement spare.

NOTE

All jumper connections must be identical on modules that are removed and modules that are inserted before swapping can be successfully used as a troubleshooting technique.

b. Installation of Additional Modules

When new functions (optional modules) are added, refer to the pertinent module section in this manual for proper jumpering information.

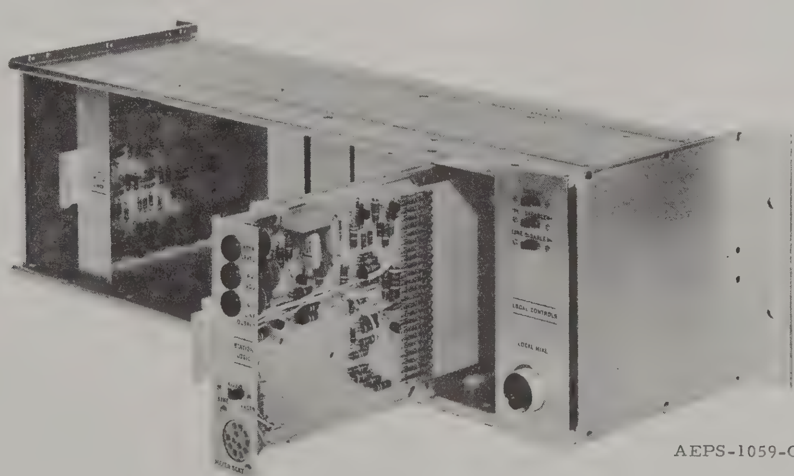
To remove the station local control panel, the station logic module and two mounting screws on the front panel of the local control panel must be removed. Sufficient service loop is provided in the panel intercabling to allow free movement of the panel to pull it out for service. Individual plug-in pins mate with the interconnect board and are identified with a numbered sleeve on the female pin.

c. In-Circuit Module Servicing

The Motorola Model TLN8799A Service Board Kit is available for extending the module to provide access for service and maintenance without interrupting the power and signal connections when taking readings. See Figure 7.

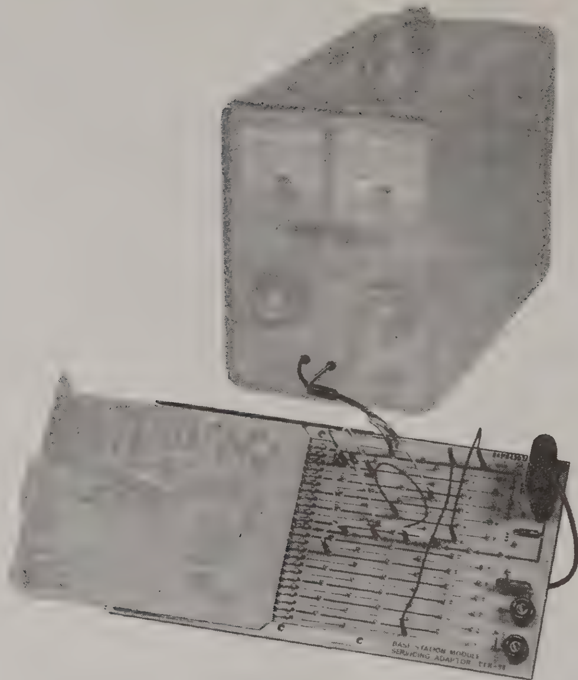
d. Out-Of-Circuit Module Servicing

A Motorola TEK-38 Base Station Module Servicing Adapter, shown in Figure 8, can be used for convenient bench testing or repair of base



AEPS-1059-O

Figure 7.
In-Circuit Module Servicing



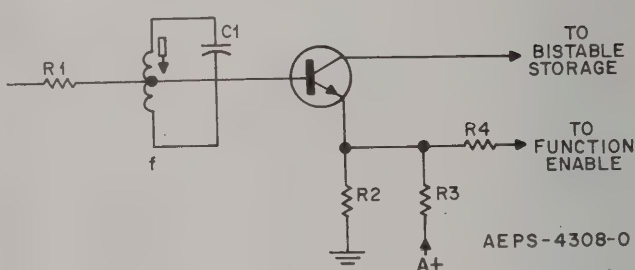
AEPS-4982-O

Figure 8.
Out-of-Circuit Module Servicing

station modules. The board provides an easy method of connecting a 12-volt power supply and an audio oscillator and allows jumpering and strapping between any pins on the module.

6. SPECIAL MODIFICATIONS

To change to Tone Decoder frequencies from the standard value, change those parts indicated per the following table and diagram.



AEPS-4308-0

Figure 9.
Typical Function Tone Detector

MODIFICATION TABLE

To Change Function Tone Tank Freq. To	R1 ±5% (In Ohms)	R2 ±5% (In Ohms)	R3 ±1% (In Ohms)	R4 ±1% (In Ohms)	C1 ±2% (In Ohms)	Capacitor Part No.
2050	27K*	1.5K	2.7K**	221	.0056	8D84326A13
1950	22K*	1K	2.2K**	221	.0062	8D84326A14
1850	18K*	1.5K	2.7K**	221	.0069	8D84326A15
1750	22K	1K	2.43K	221	.0077	8D84326A16
1650	18K	1K	2.21K	221	.00865	8D84326A17
1550	15K	1K	2.21K	221	.0098	8D84326A18
1450	12K	1K	2.21K	221	.0112	8D84326A19
1350	10K	1K	2.21K	221	.0129	8D84326A20
1250	9.1K	1K	2.43K	221	.015	8D84326A21
1150	8.2K	1K	2.43K	221	.0178	8D84326A22
1050	6.8K	1K	2.43K	221	.0213	8D84326A23

*Bistables have greater integration. For use of top three frequencies (i.e., in "Wild Card") use the next higher RETMA value for drive resistor, R1.
**±5% is allowable.

EXAMPLE: Changing "Wild Card" frequency to 1850.

FREQ.	R1	R2	R3	R4	C1
1850	22K ±5%	1.5K ±2%	2.7K ±5%	221 ±1%	.0069 uF ±2%

THIS CHART SHOWS THE POINTS INTERCONNECTED BY THE CHASSIS INTERCONNECT BOARD, AND IS PROVIDED AS A SUBSTITUTE FOR TRACING BOARD PLATING.															JUMP
FUNCTION	LOCAL CONT (LOCAL CONTROL MODULE)	J2 (UPRIGHT MODELS) J9 ("COMPA-STATION" MODELS)	SLM (STATION LOGIC MODULE)	J3 (UPRIGHT MODELS) J10 ("COMPA-STATION" MODELS)	LDM (LINE DRIVER MODULE)	F1-PL (F1-"PL" DISABLE CONTROL MODULE)	GT (GUARD-TONE DECODER MODULE)	SQ (SQUELCH-GATE MODULE)	F2 (SINGLE-TONE DECODER/ PAGING/F2 MODULE)	P-T-T (LOCAL PUSH-TO-TALK SWITCH)	OP (SQUELCH/REPEATER/ "PL" CONTROL MODULE)	W.C. (WILD CARD MODULE)	4WA (4-WIRE AUDIO MODULE)	T-O-T (TIME-OUT TIMER MODULE)	LEFT (BOTTOM) END
GROUND	1*	9B	1			1	1	1	1, 16	X	1	1		1	
"PL" DISABLE (R2)	2	3C													
"PL" DISABLE (R1)	3	2B													
"PL" DISABLE (TRANSMIT)	4	7B	20			21					20			20	
SWITCHED LINE (+) NOTE 1	5														
LINE DISABLE (TONE)/LINE (-) NOTE 2	6*														
"PL" TONE OUTPUT (LO)	7	1C													
"PL" TONE OUTPUT (HI)	8	2C													
REGULATED +8.8 V DC	9	1B				11									
PUSH-TO-TALK CONTROL	10**	1A	10			24									
DELAYED PUSH-TO-TALK	11	2A	13												
A+	12	3A	12		12	12	12	12	12		12		12	12	5
METER (+)	13	3B													
LOCAL PUSH-TO-TALK/PUSH-TO-TALK CONTROL	14**	4A						18		X				6	
METER EXCITER (+)	15	4B													
METER (-)	16	5A													
DC (+) NOTE 1	17														
LINE DISABLE GND (TONE)/ SWITCHED LINE (-) NOTE 2	18						7								
XMIT "PL" DEFEAT/METER RCVR 2	19	6A							14						
METER EXCITER (-)	20	6B													
METER PA GRID	21	7A													
METER RCVR 1	22	8A													
MIC AUDIO GND	23	8B	15												
MIC AUDIO HI	24	9A				22									
SWITCHED A+		4C	6			10	6	6							
LINE (+) NOTE 1		5B	18		16										
XCTR GND		5C	11			17		24					15		
R1 DISCRIMINATOR		6C	19					10	3						
---		7C													1
R1 LINE LEVEL		8C	23												
R1 COMMON		9C	24												
ANT. RELAY SWITCH/AUDIO DISABLE/LINE DRIVER DISABLE NOTE 2			2	8A	2								2		
R1 MUTE			3												
XCTR LEVEL			4		19								19		6
REPEATER LEVEL			5					13							
R1 MUTE INHIBIT			7					17							
XMTR KEY INHIBIT/TIME-OUT TIMER OUTPUT NOTE 2			8											4	
REDUNDANCY A+ NOTE 1			9												
LINE PUSH-TO-TALK			14			19	16	16							
XCTR INPUT			16			18									
LINE (-) NOTE 1			17	9A	17										
R1 SQUELCH			21												2
--- NOTE 3			22NP												
LINE-DRIVER MODULE GROUND				1A	1	4	17						1		
LINE-DRIVER R2 INPUT				1B	5	8									3
R1 INPUT				1C	3	6									
--- NOTE 3				2A											
--- NOTE 3				2B											
R1 OSCILLATOR NOTE 1				2C					15						
LINE (+) NOTE 1				3A									16		
REPEATER PUSH-TO-TALK				3B				15							
"PL" INDICATOR				3C				14							
R2 MUTE NOTE 2				4A					7						
R2 LINE LEVEL NOTE 2				4B					23						
SWITCHED GROUND/R2 OSCILLATOR NOTE 2				4C					17						
F1 CHANNEL ELEMENT SWITCHED GROUND NOTE 2				5A		3	3	3	6						
R2 SQUELCH NOTE 2				5B					21						
R2 DISCRIMINATOR NOTE 2				5C					22						
F2 CHANNEL ELEMENT SWITCHED GROUND NOTE 2				6A					4						
AUDIO LO				6B	20										
REPEATER A+				6C				20							
XMTR OSCILLATOR GROUND				7A		2	2	2	2						
R2 MUTE/RPTR INHIBIT				7B				21			9				
LOCAL AUDIO HI				7C	21										
LINE (-) NOTE 1				8B									17		
SWITCHED AUDIO HI				8C	22										
R2 COMMON NOTE 2				9B					24						
LINE DRIVER OUTPUT				9C	23										
LINE DRIVER R1 INPUT					4	7									
--- NOTE 3					6NP										
--- NOTE 3					7NP										
--- NOTE 3					8NP										
TONE CONTROL INPUT/TONE DECODER INPUT NOTE 2					9		9						9		

IS CHART SHOWS THE POINTS TERCONNECTED BY THE IASSIS INTERCONNECT BOARD, ND IS PROVIDED AS A SUBSTI- UTE FOR TRACING BOARD LATING. FUNCTION	LOCAL CONT (LOCAL CONTROL MODULE)	J2 (UPRIGHT MODELS) J9 ("COMPA-STATION" MODELS)	SLM (STATION LOGIC MODULE)	J3 (UPRIGHT MODELS) J10 ("COMPA-STATION" MODELS)	LDM (LINE DRIVER MODULE)	F1-PL (F1-"PL" DISABLE CONTROL MODULE)	GT (GUARD-TONE DECODER MODULE)	SQ (SQUELCH-GATE MODULE)	F2 (SINGLE-TONE DECODER/ PAGING/F2 MODULE)	P-T-T (LOCAL PUSH-TO-TALK SWITCH)	OP (SQUELCH/REPEATER/ "PL" CONTROL MODULE)	W.C. (WILD CARD MODULE)	4WA (4-WIRE AUDIO MODULE)	T-O-T (TIME-OUT TIMER MODULE)	JUMPERS LEFT (BOTTOM) END	JUMPERS RIGHT (TOP) END
- NOTE 3					10NP											
- NOTE 3					11											
- NOTE 3					13NP											
- NOTE 3					14											
- NOTE 3					15NP											
- NOTE 3					18											
KR LEVEL					24								24			
L" ENABLE						5			5		5					
ITCHED +8.8 V DC						9			8							
CAL F1 SELECTION						13			10							
NCTION - TONE HI						14	11		11		11	11	11	11		
CODER BIAS SWITCH						15	15									
CAL XMIT DEFEAT						16	13									
NCTION ENABLE						20			13		13	13	13	13		
CAL F1/F2 GROUND						23			20			7				
- NOTE 3							4NP									
- NOTE 3							5NP									
- NOTE 3							8NP									
- NOTE 3							10NP									
- NOTE 3							14NP									
- NOTE 3							18NP									
- NOTE 3							19NP									
- NOTE 3							20NP									
- NOTE 3							21NP									
- NOTE 3							22NP									
- NOTE 3							23NP									
- NOTE 3							24									
- NOTE 3								4								
- NOTE 3								5NP								
- NOTE 3								7NP								
NGLE-TONE DECODER RESET								8	9							
IETING INDICATOR NOTE 1								9								
- NOTE 3								11NP								
UELCH-GATE INHIBIT								19	18							
ME-OUT-TIMER RESET								22						22		
- NOTE 3								23NP								
OUND									19							
NOTE 3											2NP					
NOTE 3											3NP					
NOTE 3											4NP					
NOTE 3											6NP					
NOTE 3											7NP					
NOTE 3											8NP					
NOTE 3											10NP					
NOTE 3											14NP					
NOTE 3											15NP					
NOTE 3											16NP					
NOTE 3											17NP					
SQUELCH ATTENUATOR											18					4
SQUELCH											19					2
NOTE 3											21NP					
NOTE 3											22NP					
NOTE 3											23NP					
NOTE 3											24NP					
NCTION 1 LOCAL RESET												2				
NCTION 1 N.O. CONTACT/ TABLE GROUND OUTPUT TE 2												3				
NCTION 1 COMMON												4				
NCTION 1 N.C. CONTACT												5				
NCTION 2 LOCAL RESET												6				
NCTION 2 N.O. CONTACT/ TABLE GROUND OUTPUT												8				
NCTION 2 COMMON												9				
NCTION 2 N.C. CONTACT												10				
												12				5
NCTION 3 LOCAL RESET												14				
NOTE 3												15				
NCTION 3 N.O. CONTACT/ TABLE GROUND OUTPUT												16				
NCTION 3 N.C. CONTACT												17				
NCTION 3 COMMON												18				
ITCHED A+												19				
NCTION 4 LOCAL RESET												20				
NOTE 3												21				
NCTION 4 N.C. CONTACT												22				
NCTION 4 N.O. CONTACT/ TABLE GROUND OUTPUT												23				
NCTION 4 COMMON												24				
NOTE 3													3			
INPUT NOTE 3													4			
INPUT													5			3

THIS CHART SHOWS THE POINTS INTERCONNECTED BY THE CHASSIS INTERCONNECT BOARD, AND IS PROVIDED AS A SUBSTITUTE FOR TRACING BOARD PLATING.

FUNCTION	LOCAL CONT (LOCAL CONTROL MODULE)	J2 (UPRIGHT MODELS) J9 ("COMPA-STATION" MODELS)	SLM (STATION LOGIC MODULE)	J3 (UPRIGHT MODELS) J10 ("COMPA-STATION" MODELS)	LDM (LINE DRIVER MODULE)	F1-PL (F1-"PL" DISABLE CONTROL MODULE)	GT (GUARD-TONE DECODER MODULE)	SQ (SQUELCH-GATE MODULE)	F2 (SINGLE-TONE DECODER/ PAGING/F2 MODULE)	P-T-T (LOCAL PUSH-TO-TALK SWITCH)	OP (SQUELCH/REPEATER/ "PL" CONTROL MODULE)	W.C. (WILD CARD MODULE)	4WA (4-WIRE AUDIO MODULE)	T-O-T (TIME-OUT TIMER MODULE)	JUMI LEFT (BOTTOM) END
--- NOTE 3													6NP		
--- NOTE 3													7NP		
--- NOTE 3													8NP		
- NOTE 3													10		
XFMR (+) NOTE 3													14		
XFMR (-) NOTE 3													18		
--- NOTE 3													20NP		
AUDIO HI NOTE 3													21		
SWITCHED AUDIO HI NOTE 3													22		
--- NOTE 3													23NP		
--- NOTE 3														2NP	
--- NOTE 3														3NP	
--- NOTE 3														5NP	
--- NOTE 3														7NP	
-- NOTE 3														8NP	
-- NOTE 3														9	
--- NOTE 3														10NP	
- NOTE 3														14NP	
--- NOTE 3														15NP	
--- NOTE 3														16NP	
--- NOTE 3														17NP	
--- NOTE 3														18NP	
--- NOTE 3														19NP	
--- NOTE 3														21NP	
--- NOTE 3														23NP	
--- NOTE 3														24NP	
---															4, 1

NOTE 1 - NOT USED

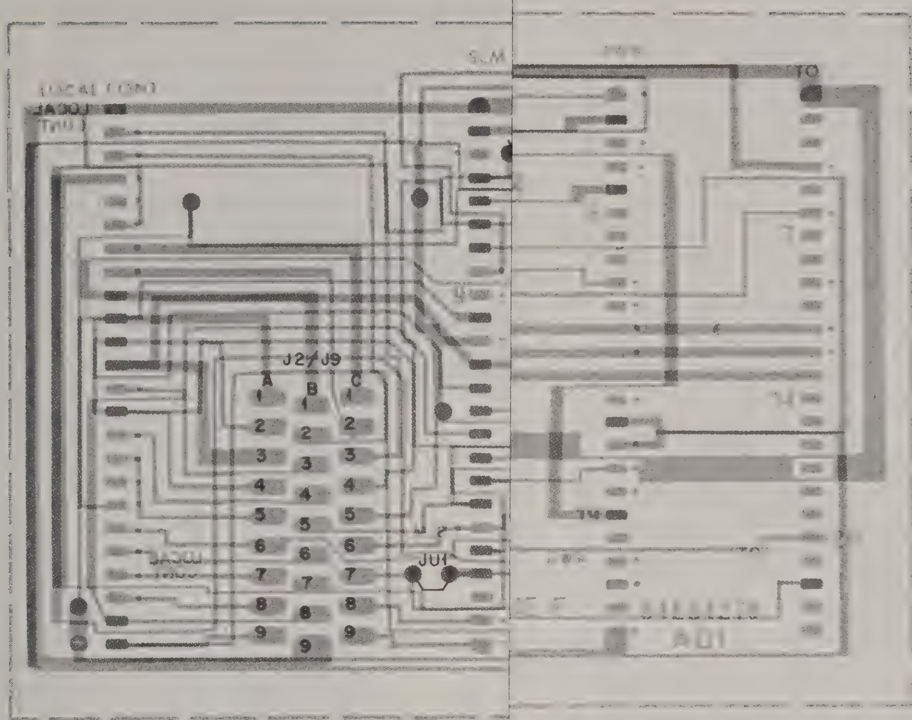
NOTE 2 - FUNCTION VARIES WITH APPLICATION.

NOTE 3 - NO CONNECTION

NOTE 4 - ALL ENTRIES ON A HORIZONTAL LINE ARE POINTS CONNECTED BY BOARD PLATING

*, ** - PLATING JUMPER TO SIMILARLY - MARKED PIN ON SAME MODULE POSITION

N.P. - NO PIN AT INDICATED POSITION.



CEPS - 1482 - A
CEPS - 1481 - A
CEPS - 1484 - B

NOTE:

REFER TO THE ACCOMPANYING CHART FOR AID IN TRACING POINT-TO-POINT CONNECTIONS.

EPS-4983-O

TONE REMOTE CONTROL CHASSIS

ARTS LIST SHOWN ON
ACK OF THIS DIAGRAM

CN1094A Tone Remote Control Chassis
Viring Diagram
Motorola No. 63P81009E64-B
Sheet 2 of 2)
2/13/71-UP

THIS CHART SHOWS THE POINTS INTERCONNECTED BY THE CHASSIS INTERCONNECT BOARD, AND IS PROVIDED AS A SUBSTITUTE FOR TRACING BOARD PLATING.

FUNCTION	LOCAL CONT (LOCAL CONTROL MODULE)	J2 (UPRIGHT MODELS) J9 ("COMPA-STATION" MODELS)	SLM (STATION LOGIC MODULE)	J3 (UPRIGHT MODELS) J10 ("COMPA-STATION" MODELS)	LDM (LINE DRIVER MODULE)	F1-PL (F1-"PL" DISABLE CONTROL MODULE)	GT (GUARD-TONE DECODER MODULE)	SQ (SQUELCH-GATE MODULE)	F2 (SINGLE-TONE DECODER/PAGING/F2 MODULE)	P-T-T (LOCAL PUSH-TO-TALK SWITCH)	OP (SQUELCH/REPEATER/"PL" CONTROL MODULE)	W.C. (WILD CARD MODULE)	4WA (4-WIRE AUDIO MODULE)	T-O-T (TIME-OUT TIMER MODULE)	JUMPE[R] LEFT (BOTTOM) END	
--- NOTE 3													6NP			
--- NOTE 3													7NP			
--- NOTE 3													8NP			
--- NOTE 3													10			
XFMR (+) NOTE 3													14			
XFMR (-) NOTE 3													18			
--- NOTE 3													20NP			
AUDIO HI NOTE 3													21			
SWITCHED AUDIO HI NOTE 3													22			
--- NOTE 3													23NP			
--- NOTE 3														2NP		
--- NOTE 3														3NP		
--- NOTE 3														5NP		
--- NOTE 3														7NP		
--- NOTE 3														8NP		
--- NOTE 3														9		
--- NOTE 3														10NP		
--- NOTE 3														14NP		
--- NOTE 3														15NP		
--- NOTE 3														16NP		
--- NOTE 3														17NP		
--- NOTE 3														18NP		
--- NOTE 3														19NP		
--- NOTE 3														21NP		
--- NOTE 3														23NP		
--- NOTE 3														24NP		
---															4, 1	

NOTE 1 - NOT USED

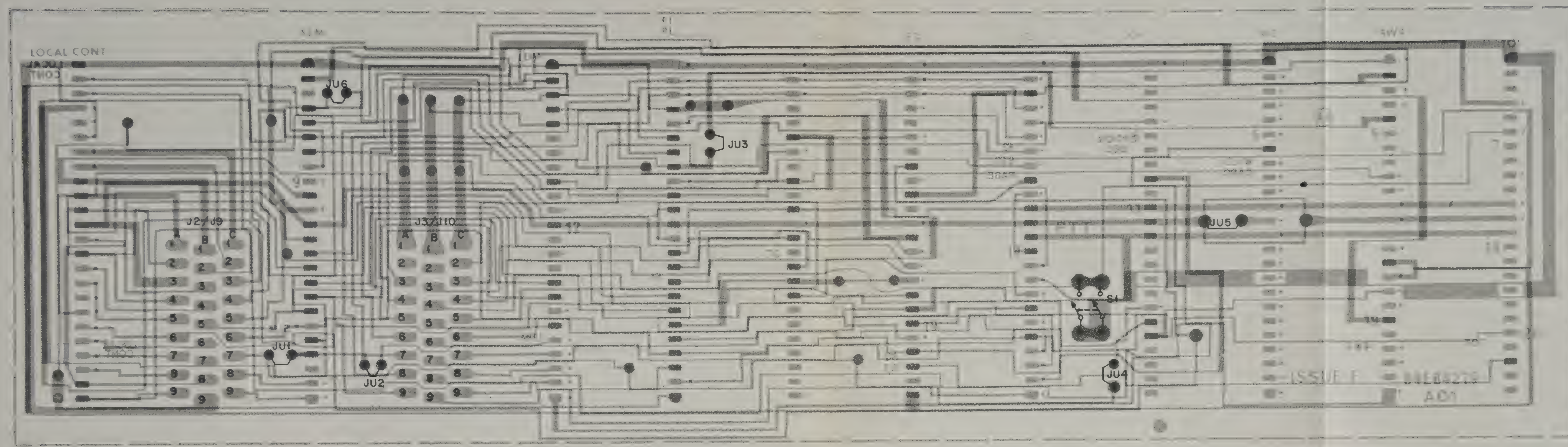
NOTE 2 - FUNCTION VARIES WITH APPLICATION.

NOTE 3 - NO CONNECTION

NOTE 4 - ALL ENTRIES ON A HORIZONTAL LINE ARE POINTS CONNECTED BY BOARD PLATING

*, ** - PLATING JUMPER TO SIMILARLY - MARKED PIN ON SAME MODULE POSITION

N.P. - NO PIN AT INDICATED POSITION.

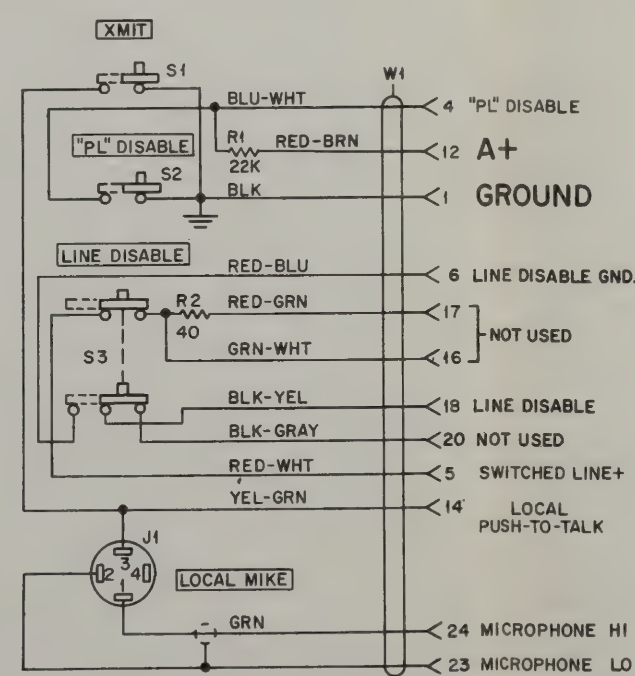


MODULE-SIDE PLATING - CEPS-1482-A
CABLING-SIDE PLATING - CEPS-1481-A
OVERLAY - CEPS-1484-B

NOTE:

REFER TO THE ACCOMPANYING CHART FOR AID IN TRACING POINT-TO-POINT CONNECTIONS.

EPS-4983-O

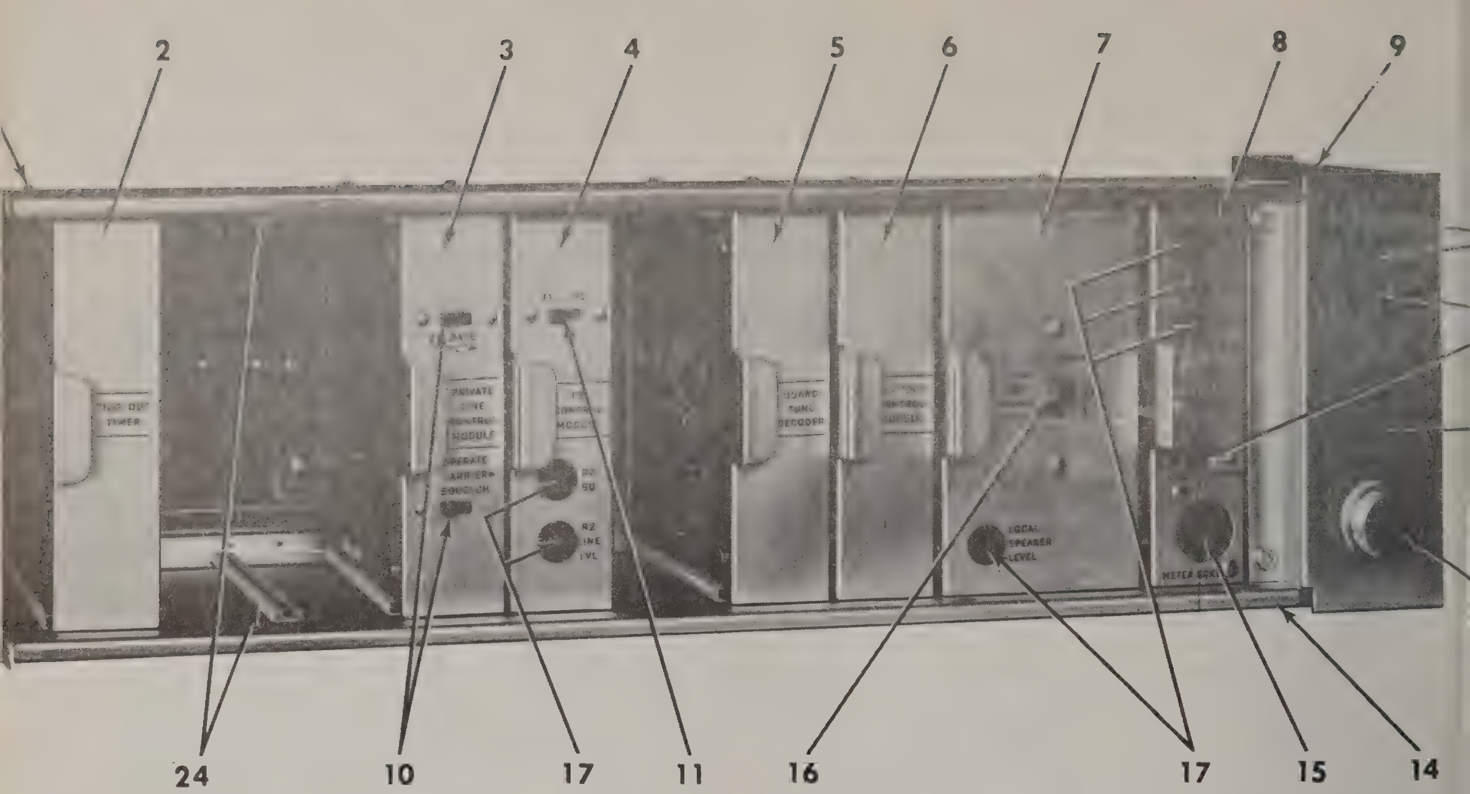


AEPS-4235-0

TONE REMOTE CONTROL CHASSIS

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TCN1094A Tone Remote Control Chassis
Wiring Diagram
Motorola No. 63P81009E64-B
(Sheet 2 of 2)
12/13/71-UP



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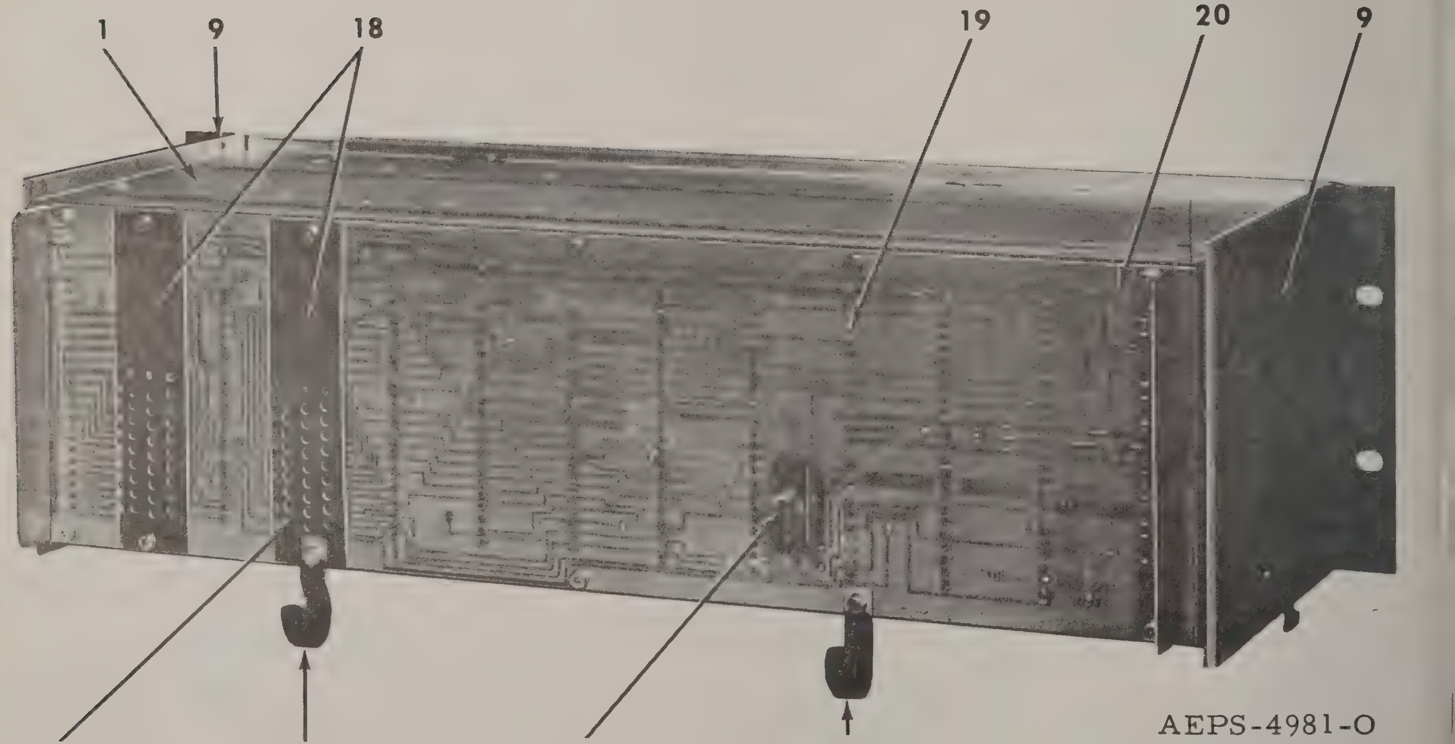
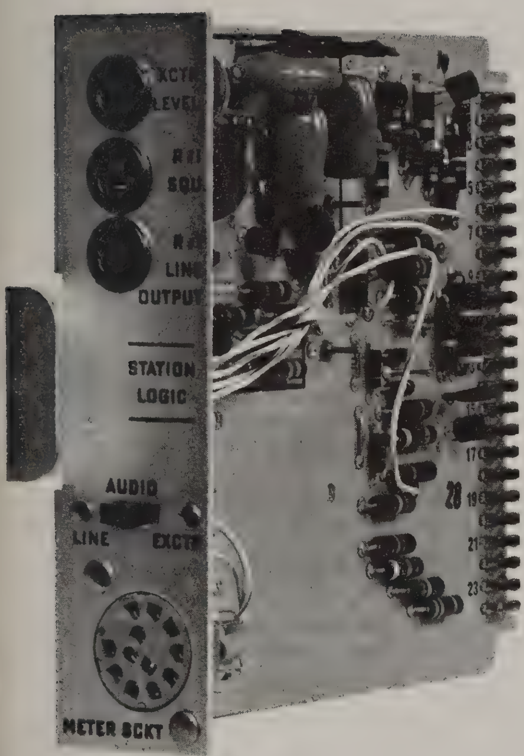


AEPS-4981-O

Tone Remote Control Cha
Mechanical Parts Detail
Motorola No. PEPS-4984-
12/13/71-UP

STATION LOGIC MODULE

MODEL TLN1173A



. DESCRIPTION

The TLN1173A Station Logic Module is a fully ransistorized, plug-in circuit module for the emote control chassis in Motorola base stations. ll components and circuitry are mounted on a turdy card with connecting terminals to mate vith the interconnect board of the remote control hassis.

. FUNCTIONS

This module contains the line output level nd squelch controls for the station receive audio, and amplification and level adjustment of the station transmit audio. It exercises push-to-talk control of the station from local or line push-to-talk commands. This push-to-talk control includes switching of the antenna relay, receiver muting, line driver disable, power supply turn-on, and transmitter channel element turn-on. Sequencing circuits are included to switch the antenna relay before activating high power transmitter rf circuits. For repeater applications, a receiver mute inhibit input allows the receiver to continue operating while the transmitter is keyed. Additionally, the metering socket for testing the station logic control functions is located on this module.

3. CIRCUIT DESCRIPTION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

a. Control Functions

A signal from the receiver discriminator, entering the module on pin 19, is routed to the receiver squelch circuit through the R#1 SQUELCH control and pin 21. The signal also passes through the R#1 LINE OUTPUT control to pin 23 for amplification in the receiver audio stages when the receiver is unsquelched.

b. Audio Functions

An audio signal entering the module on pin 4 passes through capacitor C1 into the XCTR LEVEL control and into Paraphase Amplifier Q1. For the line levels below $\overline{0\text{ dBm}}$, JU2 is installed. If the

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REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN8760A Local Station Control Panel PL-268-O

J1	9K830418	CONNECTOR, receptacle: female; 4 contact; does not include; 4S7699 LOCKWASHER 13/16"; 2A482070 NUT, ring
		RESISTOR, fixed:
R1	[illegible]	22K ±10%; 1/4 w
R2	17C82036G31	40 ±2%; 2 w
		SWITCH, slide:
S1, 2	40B83468E01	spst
S3	40B83204B01	dpst
		CABLE ASSEMBLY:
W1	1V80700B34	includes ref. parts R1, R2, misc. leads and the following: 9B83012H01 RECEPTACLE, wire crimp; 11 req'd.
		SLEEVING, coded
		37C82603D01 No. 1
		37C82603D04 No. 4
		37C82603D05 No. 5
		37C82603D06 No. 6
		37C82603D12 No. 12
		37C82603D14 No. 14
		37C82603D16 No. 16
		37C82603D17 No. 17
		37C82603D18 No. 18
		37C82603D23 No. 23
		37C82603D24 No. 24
	NON-REFERENCED ITEM	
	64B83916G01	BRACKET, panel

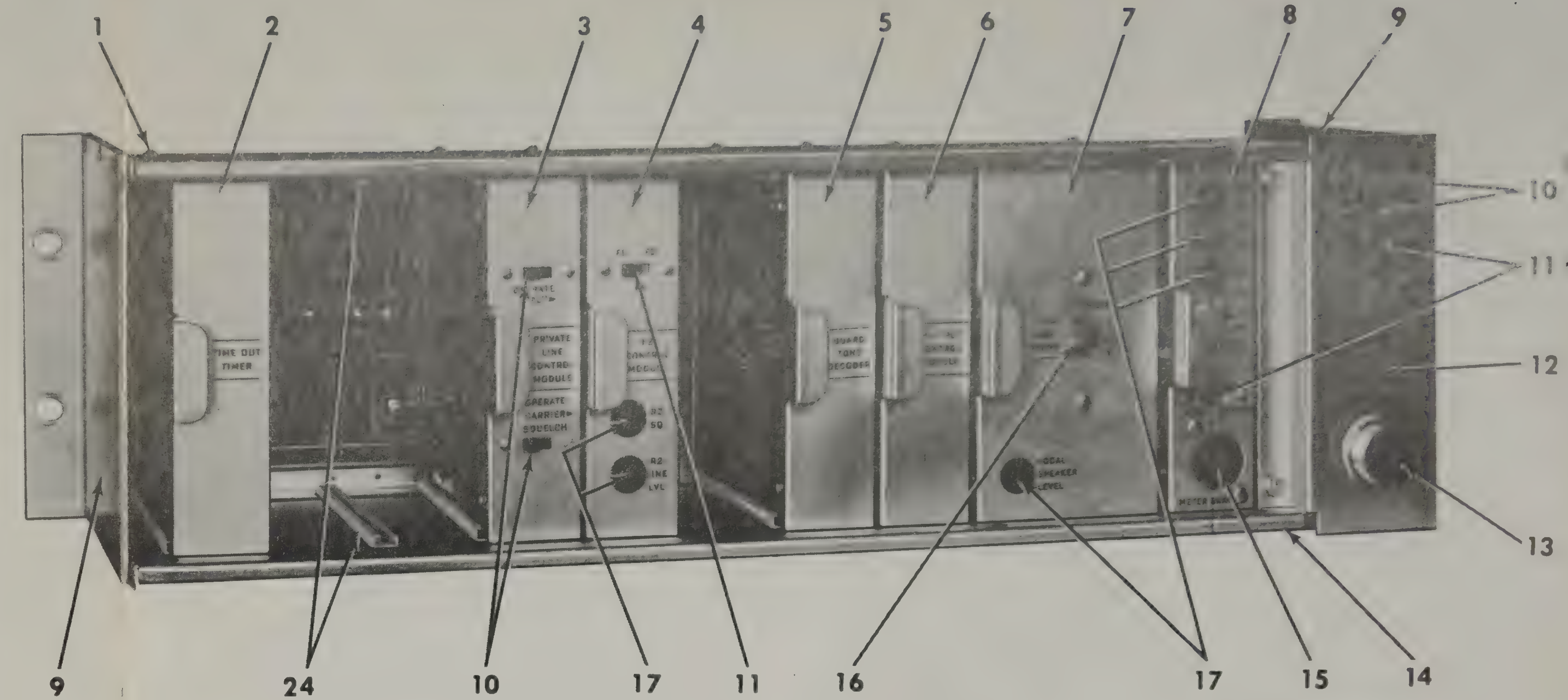
TLN4058A Interconnect Board PL-553-O

	40B82786A02	SWITCH, push: dpst; momentary
	29C84028H09	TERMINAL, contact: male
	9B83965G01	TERMINAL, contact: female

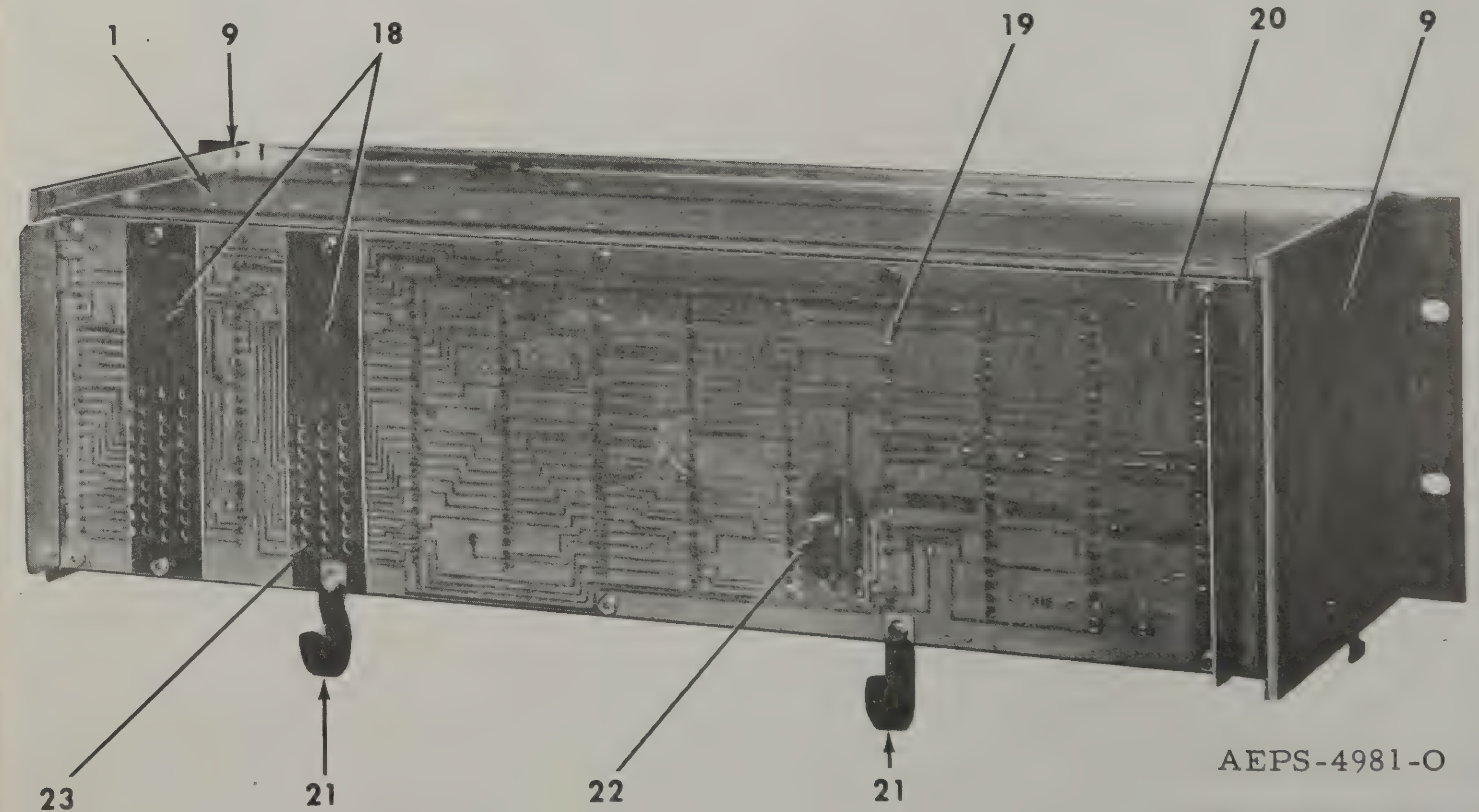
PARTS LIST

PL-1202-A

CODE	MOTOROLA PART NO.	DESCRIPTION
1	15D83913G01	Housing (top)
2	64B83927G01	Time-Out Timer Panel
3	1V80702B22	"Private-Line" Control Module Panel Assembly (incl. 2 switches, item 10)
4	1V80702B17	F2 Control Module Panel Assembly (incl. slide switch, item 11)
5	64B84316A01	Guard Tone Decoder Panel
6	64B84317A01	F1-"PL" Control Module Panel
7	1V80781A47	Line Driver Panel Assembly (incl. 3pdt switch, item 16)
8	1V80781A26	Station Logic Panel Assembly (includes slide switch, item 11 and meter socket, item 15)
9	15C83911G01	Housing (end)
10	40B83468E01	Switch, slide (momentary)
11	40B83204B01	Switch, slide
12	1V80781A16	Local Controls Panel Ass'y (incl. 2 switches, item 10, and 1 switch, item 11)
13	9K830418	Receptacle, Microphone Conn.
14	15D83912G01	Housing (bottom)
15	8C83478E01	Receptacle, Metering
16	40B83881C01	Switch, 3pdt
17	43B82721C01	Insulator, Bushing
18	14B83127H01	Connector, Insulated
19	29C84028H09	Terminal, receptacle
20	1V80702B03	Circuit Board Ass;y (incl. terminals, item 19 and receptacles, item 23)
21	42K863549	Clamp, Cable
22	40B82786A02	Switch, push
23	29S10134A29	Receptacle, Board mtg
24	45B83914G01	Guide, circuit board
	PARTS NOT SHOWN	
	1V80702B18	F2-R2 Mute Control Panel Assembly, incl. 2 slide switches (40B83468E01) and 1 slide switch (40B83204B01)
	1V80703B19	C2-R2 Control Module Panel Assembly; incl. 2 slide switches (40B83468E01) and 1 slide switch (40B83204B01)
	1V80702B20	Squelch Control Module Panel Assembly; incl. two 40B83468E01 Slide Switches
	1V80702B21	Repeater Control Module Panel Assembly; incl. two 40B83468E01 Slide Switches
	1V80702B24	"Wild Card" Control Module Panel Assembly; incl. four 40B83468E01 Slide Switches
	1V80702B25	Paging Control Module Panel Assembly; incl. 40B83204B01 Slide Switch
	64B83926G01	Squelch Gate Module Panel
	1V80702B70	Single-Tone Decoder Panel Assembly; incl. one 40B83468E01 Slide Switch and one 40B83204B01 Slide Switch



AEPS-4980-O

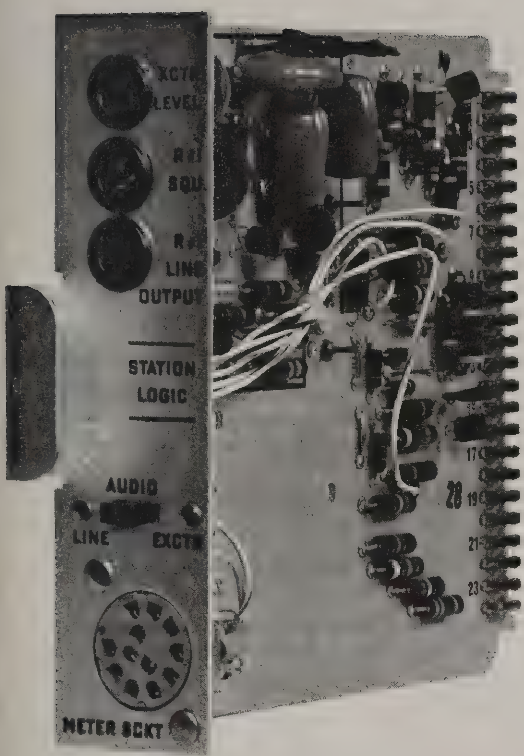


AEPS-4981-O

Tone Remote Control Chassis
Mechanical Parts Detail
Motorola No. PEPS-4984-A
12/13/71-UP

STATION LOGIC MODULE

MODEL TLN1173A



. DESCRIPTION

The TLN1173A Station Logic Module is a fully ransistorized, plug-in circuit module for the emote control chassis in Motorola base stations. .ll components and circuitry are mounted on a turdy card with connecting terminals to mate ith the interconnect board of the remote control hassis.

. FUNCTIONS

This module contains the line output level nd squelch controls for the station receive audio, and amplification and level adjustment of the station transmit audio. It exercises push-to-talk control of the station from local or line push-to-talk commands. This push-to-talk control includes switching of the antenna relay, receiver muting, line driver disable, power supply turn-on, and transmitter channel element turn-on. Sequencing circuits are included to switch the antenna relay before activating high power transmitter rf circuits. For repeater applications, a receiver mute inhibit input allows the receiver to continue operating while the transmitter is keyed. Additionally, the metering socket for testing the station logic control functions is located on this module.

3. CIRCUIT DESCRIPTION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

a. Control Functions

A signal from the receiver discriminator, entering the module on pin 19, is routed to the receiver squelch circuit through the R#1 SQUELCH control and pin 21. The signal also passes through the R#1 LINE OUTPUT control to pin 23 for amplification in the receiver audio stages when the receiver is unsquelched.

b. Audio Functions

An audio signal entering the module on pin 4 passes through capacitor C1 into the XCTR LEVEL control and into Paraphase Amplifier Q1. For the line levels below $\overline{0\,\text{dBm}}$, JU2 is installed. If the

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level is above 0 dBm, JU2 is not used. From the collector of Q1, the amplified signal is sent to Exciter Audio Amplifier Q2 for further amplification and out the transmitter exciter audio input.

The Repeater Level control (external to the module) is connected to the circuit through pin 5 at diode CR1. When a high-resistance path appears at pin 5, CR1 is reverse-biased, and the audio path from pin 4 is through amplifier Q1 as previously described. When the path at pin 5 becomes a low resistance, diode CR1 becomes forward-biased and gates the signal around Paraphase Amplifier Q1. The signal then feeds into Exciter Audio Amplifier Q2 as before.

The Local Mic Audio Switch is normally conducting to provide a ground for local microphone audio. Whenever line push-to-talk occurs, Q3 is cut off, removing the local microphone audio ground path. This cutoff gives line audio priority over local microphone audio signals.

c. Circuit Control Functions

When a local or line push-to-talk input is applied to pin 10 or 14, it is applied to the base of P-T-T Inverter, Q4. The "low" input is changed to a "high" level in the inverter, then applied to the Antenna Relay and Mute Switch.

In "Private-Line" applications, push-to-talk release is delayed at the end of a transmission by an input to pin 13 from the external "Private-Line" reverse-burst circuitry. This input holds the P-T-T circuit operated for the duration of the reverse-burst tone.

When a "high" from the P-T-T Inverter is received at the Antenna Relay and Mute Switch, a "low" at its output mutes receiver No. 1 and operates the antenna relay switch, audio disable, and line driver disable circuits.

In repeater applications, a ground appears at pin 7, which prevents Mute Switch Q6 from operating. This allows the receiver in the repeater to remain operational for retransmission of the received signal.

The P-T-T Inverter controls the switched A+. Switched A+ is applied after a 35-millisecond delay to allow the antenna relay to switch to the transmit position before the rf power is applied. A+ from the external redundancy circuit must also be present through pin 9 for switched A+ to be present. When the redundancy input is present, and the switched A+ is turned on by the P-T-T Inverter, the external transmitter circuits are energized to produce an rf output.

In repeater applications without wire-line control, jumper JU1 is used and switched A+ is provided without the redundancy input previously described.

When the time-out timer reaches the end of its cycle, the Transmitter Key Inhibit (through pin 8 on the module) removes the switched A+.

d. Metering Facilities

A receptacle is provided on the module front panel for metering of the functions available at the module. The functions metered and their corresponding Motorola Test Set positions are given in the following table:

METERING TABLE

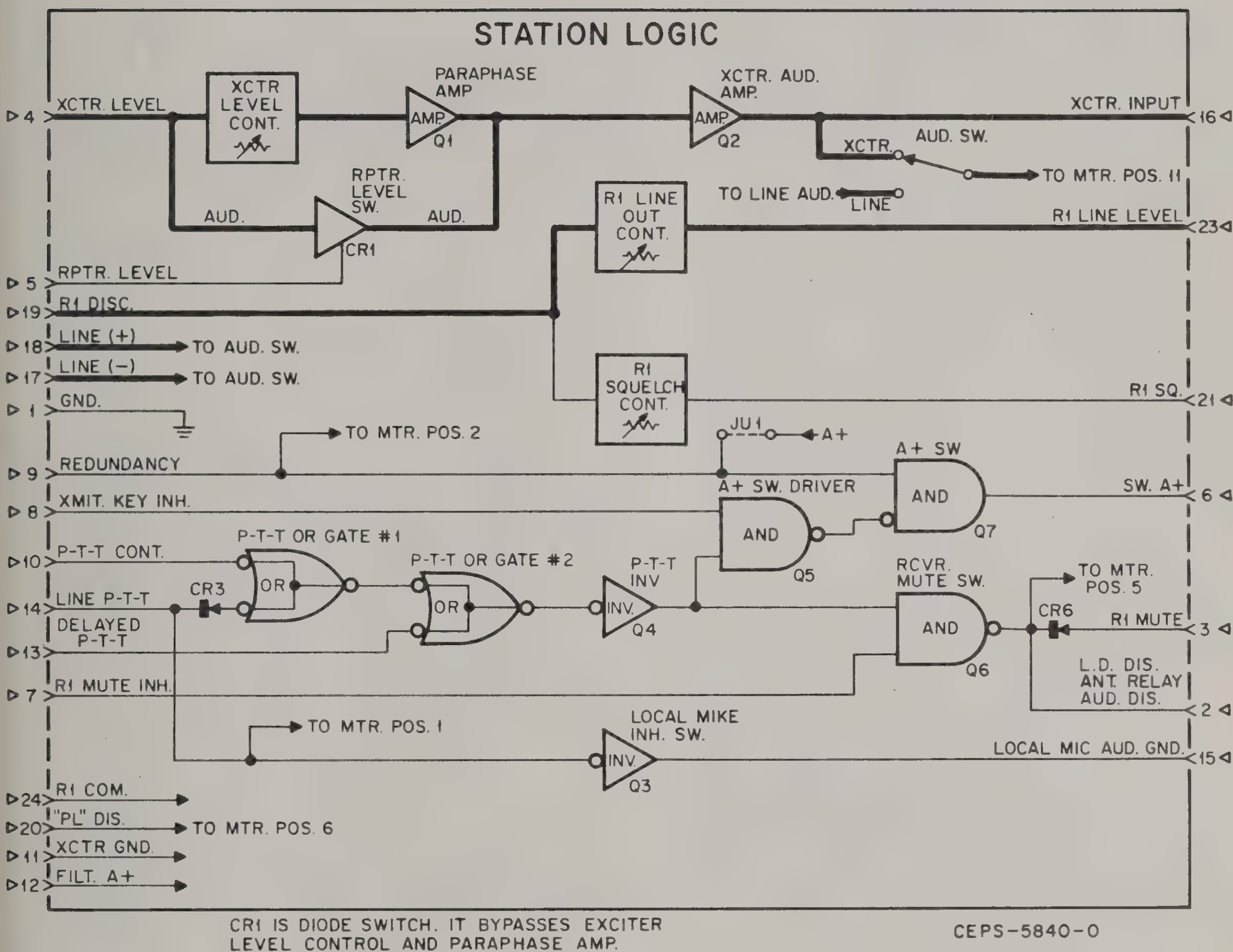
SET UP THE PORTABLE TEST SET AS FOLLOWS:

1. Function switch - XMTR position.
2. Oscillator switch - METER REV. position.
3. The AUDIO switch on the Station Logic Module must be in the EXCTR position to provide a ground for the test set meter.

SELECTOR SWITCH POSITION	CIRCUIT CHECKED	TYPICAL METER READING	
		STANDBY	TRANSMIT
1	LINE P-T-T	25 uA (NOTE 1)	0
2	REDUNDANCY	0 (NOTE 5)	40 uA
3	SWITCHED A+	0	40 uA
5	RCVR MUTE	20 uA	0 (NOTE 2)
6	"PL" DISABLE	20 uA (NOTE 6)	0 (NOTE 3 & 6)
11	AUDIO	(NOTE 4)	

NOTES:

1. No reading when keyed locally or in repeater operation.
2. Remains 20 uA during repeater operation.
3. Meter reading is for PL disable condition rather than transmit condition.
4. Dependent upon audio levels used at the individual station. Refer to the INSTALLATION AND OPERATION section of the manual for set-up instructions and typical readings.
5. 25 min in tone remote control applications.
6. 2 uA in community repeaters.



Functional Block Diagram

STATION LOGIC MODULE

4. MAINTENANCE AND TROUBLESHOOTING

a. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access, remove the module, insert the Model TKN8799A Module Extension Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

Servicing may be done without connection to a remote control chassis if the proper power and terminations are connected to the module. A convenient method of connection is through the use of a TEK-38 Base Station Module Servicing Adapter. The module is simply plugged into the 24 pin male plug of the adapter. Connections are then made to the circuit module via the adapter using the standard and/or resistor push on patch leads supplied with the adapter.

Make the connections shown in the following out of the circuit servicing chart.

PIN NO.	CONNECT
1, 11, 24	Ground
4	Audio oscillator through 0.1 uF
12, 9	+12 volts dc
16	AC voltmeter to ground
2	10 kilohms to 12 volts dc
4	10 kilohms to 12 volts dc
6	10 kilohms to ground
NOTE: Temporarily connect JU1 for out-of-chassis servicing.	

b. Module Malfunction Location Techniques

(1) Connect voltage and signal sources to the module as indicated in the preceding table.

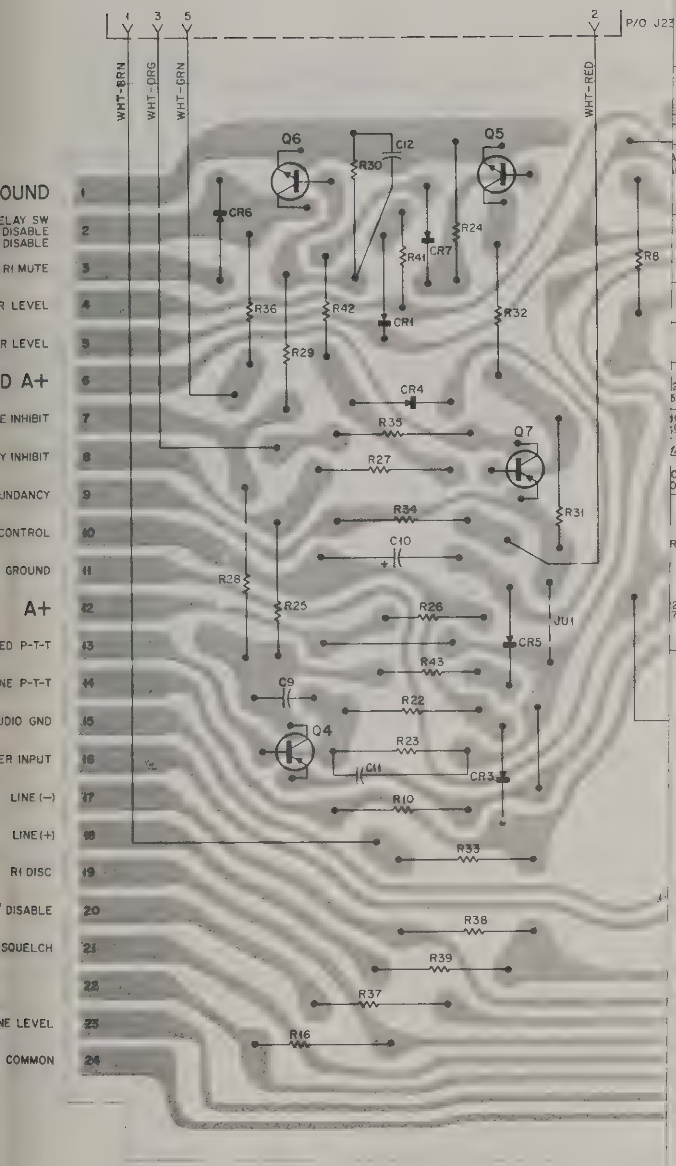
(2) Adjust the audio oscillator output for -25 dBm at pin 4. With this input, the level at pin 16 should measure approximately -10 dBm with JU2 connected. If this level cannot be achieved, check stages Q1 and Q2. If the level is correct, ground pin 5. The reading at pin 16 should fall to zero. If this does not occur, check diode CR1 and resistor R41.

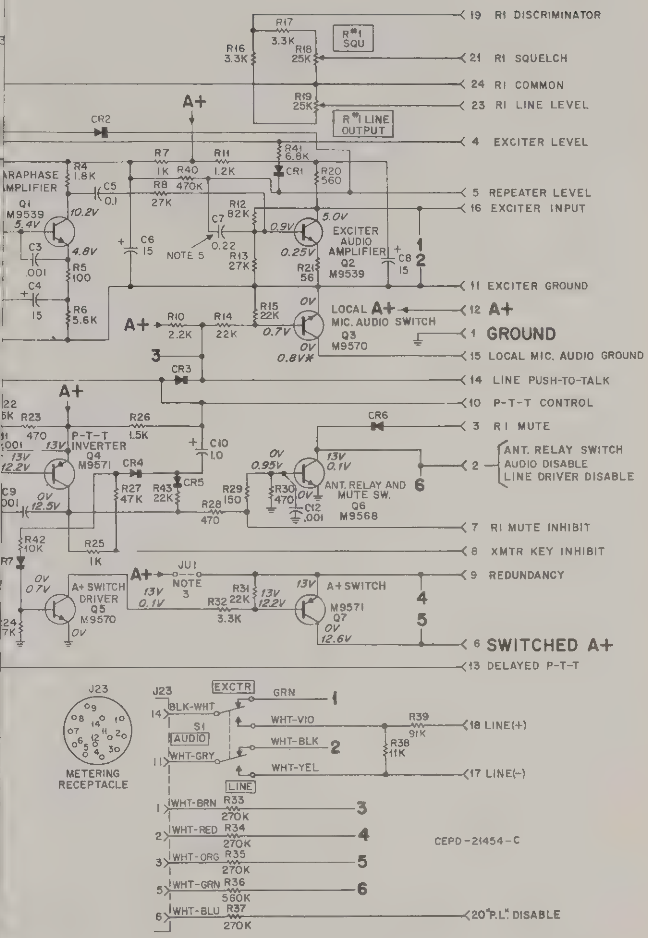
(3) Ground pin 14. With a dc voltmeter, measure the voltage at pins 6 and 15. Each should read +12 volts. The voltage measured at pin 2 should read zero.

Refer to the schematic diagram. If a voltage or ground does not appear at the prescribed location, check each stage, in turn, that feeds into the pin indicating the malfunction.

(4) With pin 14 grounded, ground pin 8. With a dc voltmeter, look for +12 volts dc at pin 2 and ground at pin 6. If these are present, the Antenna Relay and Mute Switch, A+ Switch Driver, and A+ Switch are functioning properly.

(5) With pin 14 grounded, unground pin 8 and ground pin 7. Pin 2 should read +12 volts dc and pin 6 should read +12 volts dc.





PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

TLN1173A Station Logic Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81002E44-E
3/1/72-UP

STATION LOGIC MODULE

4. MAINTENANCE AND TROUBLESHOOTING

a. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access, remove the module, insert the Model TKN8799A Module Extension Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

Servicing may be done without connection to a remote control chassis if the proper power and terminations are connected to the module. A convenient method of connection is through the use of a TEK-38 Base Station Module Servicing Adapter. The module is simply plugged into the 24 pin male plug of the adapter. Connections are then made to the circuit module via the adapter using the standard and/or resistor push on patch leads supplied with the adapter.

Make the connections shown in the following out of the circuit servicing chart.

PIN NO.	CONNECT
1, 11, 24	Ground
4	Audio oscillator through 0.1 uF
12, 9	+12 volts dc
16	AC voltmeter to ground
2	10 kilohms to 12 volts dc
4	10 kilohms to 12 volts dc
6	10 kilohms to ground
NOTE: Temporarily connect JU1 for out-of-chassis servicing.	

b. Module Malfunction Location Techniques

(1) Connect voltage and signal sources to the module as indicated in the preceding table.

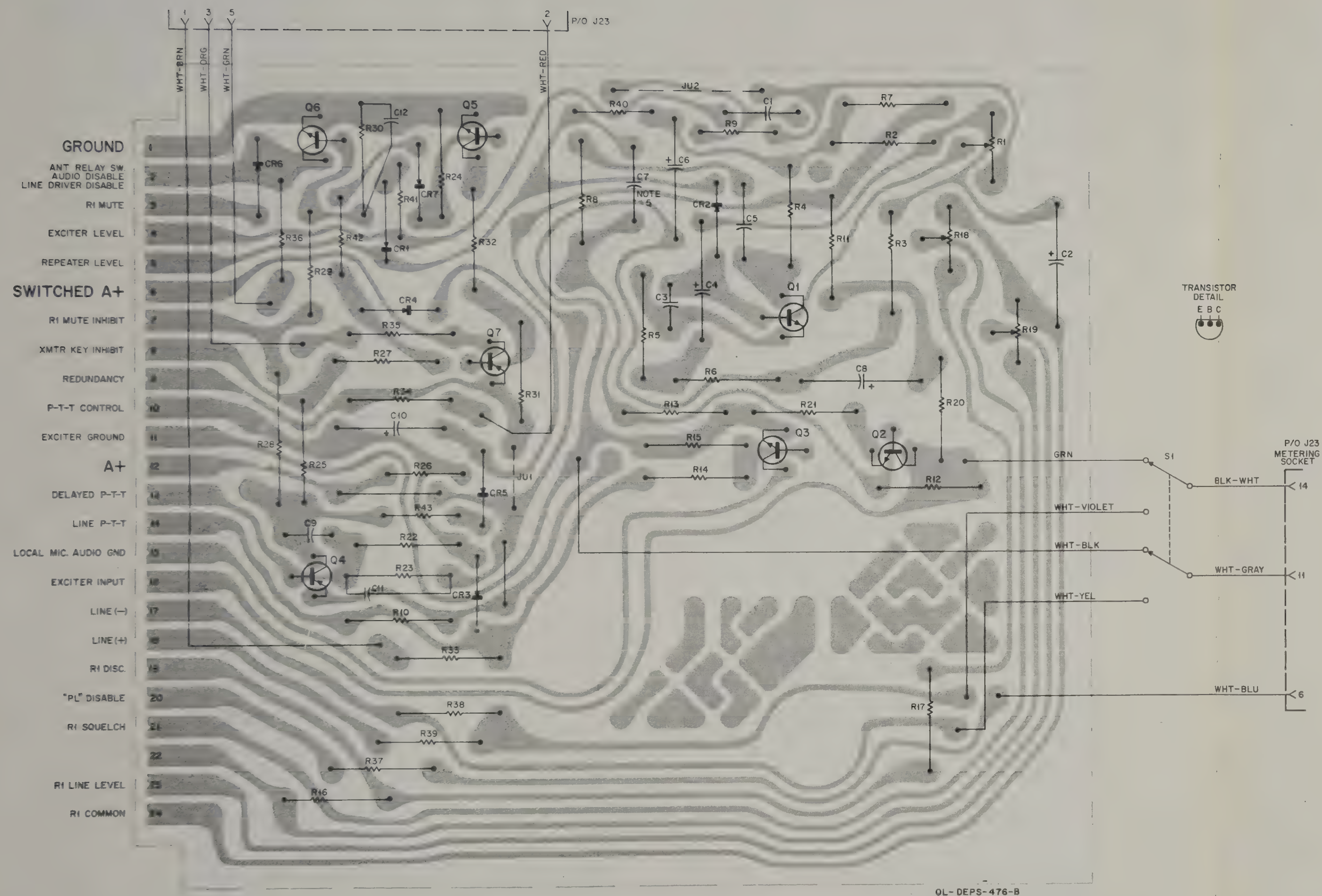
(2) Adjust the audio oscillator output for -25 dBm at pin 4. With this input, the level at pin 16 should measure approximately -10 dBm with JU2 connected. If this level cannot be achieved, check stages Q1 and Q2. If the level is correct, ground pin 5. The reading at pin 16 should fall to zero. If this does not occur, check diode CR1 and resistor R41.

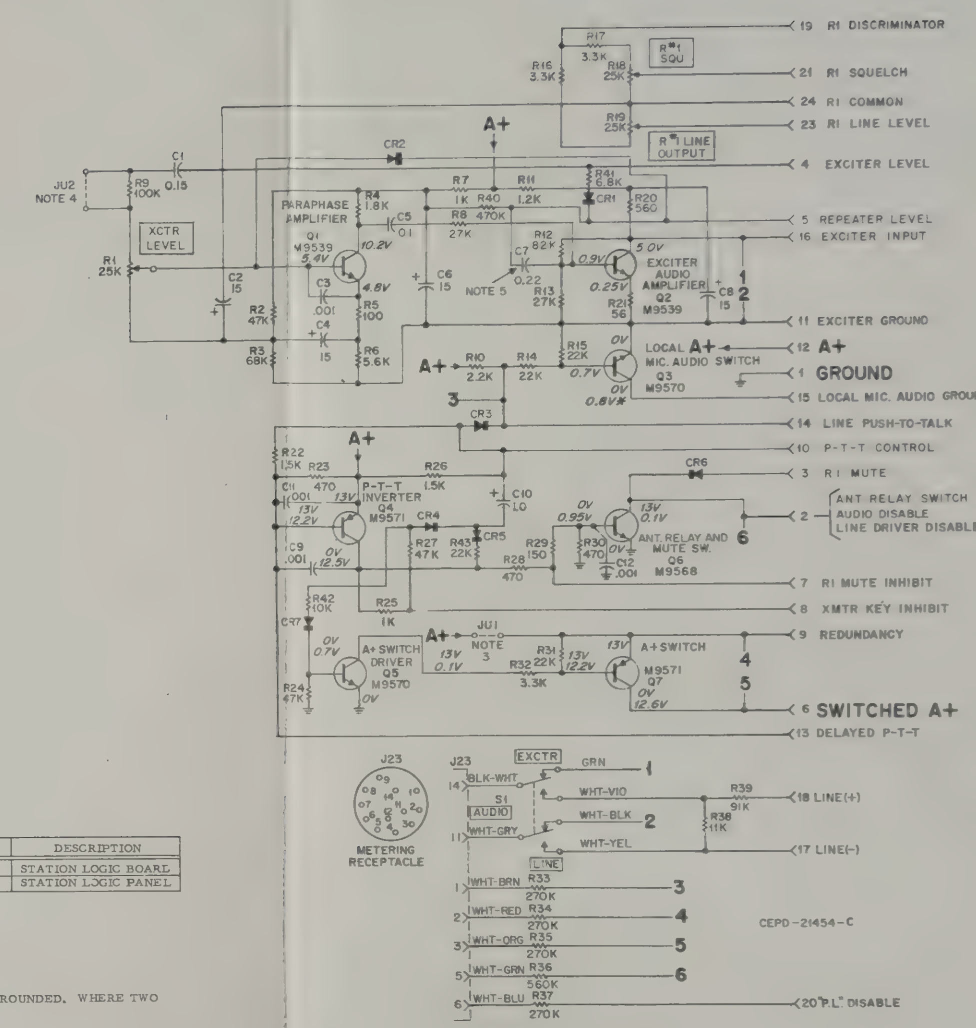
(3) Ground pin 14. With a dc voltmeter, measure the voltage at pins 6 and 15. Each should read +12 volts. The voltage measured at pin 2 should read zero.

Refer to the schematic diagram. If a voltage or ground does not appear at the prescribed location, check each stage, in turn, that feeds into the pin indicating the malfunction.

(4) With pin 14 grounded, ground pin 8. With a dc voltmeter, look for +12 volts dc at pin 2 and ground at pin 6. If these are present, the Antenna Relay and Mute Switch, A+ Switch Driver, and A+ Switch are functioning properly.

(5) With pin 14 grounded, unground pin 8 and ground pin 7. Pin 2 should read +12 volts dc and pin 6 should read +12 volts dc.





MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX	DESCRIPTION
TLN1173A		TLN8763A	1	STATION LOGIC BOARD
		TLN8764A		STATION LOGIC PANEL

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K=1000).
   CAPACITOR VALUES ARE IN MICROFARADS.
2. * INDICATES VOLTAGES WHEN LINE P-T-T IS GROUNDED. WHERE TWO VOLTAGES ARE GIVEN AT ONE POINT:
   UPPER VOLTAGE = RECEIVE
   LOWER VOLTAGE = TRANSMIT
3. JUMPER TABLE

DC AND TONE REMOTES

APPLICATION	JU1
BASE STATION	OUT*
BASE (RA) STATION	IN
REPEATER (RT) STATION WITHOUT WIRE LINE CONTROL	IN
REPEATER (RT) STATION WITH WIRE LINE CONTROL	OUT*
REPEATER (RA) STATION	IN
COMMUNITY REPEATER (RT)	IN

*"IN" ON TONE REMOTE STATIONS

4. REMOVE JUMPER JU2 WHEN THE TRANSMIT AUDIO LEVEL FROM THE REMOTE CONTROL POINT IS 0 DBM OR GREATER AS MEASURED AT THE STATION. CONNECT THE JUMPER IF THIS LEVEL IS BELOW 0 DBM.
5. C7 IS NOT USED IN C53, C63, C73MHB AND C71LHB SERIES STATIONS.

EPS-1028-D

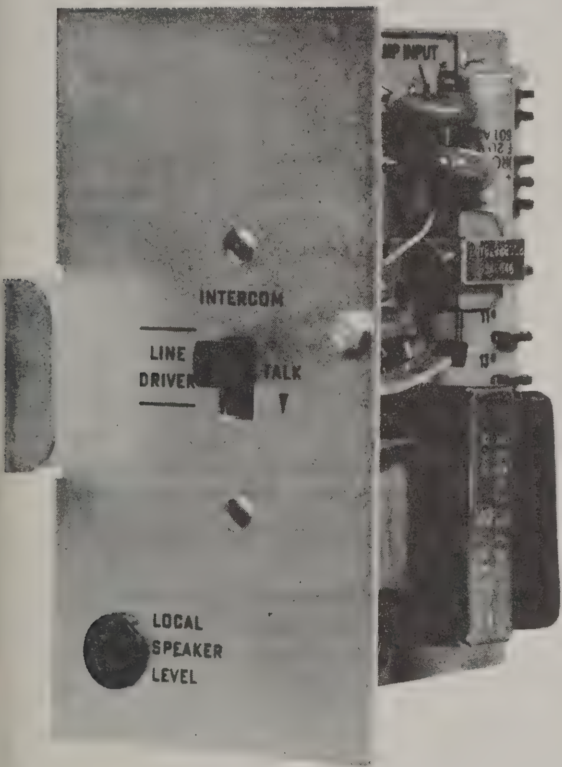
STATION LOGIC MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1173A Station Logic Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81002E44-E
3/1/72-UP

LINE DRIVER/4-WIRE AUDIO MODULE

MODEL TLN1172A



1. DESCRIPTION

The TLN1172A Line Driver Module is a fully transistorized, plug-in circuit module for the remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed. This module is also used as the 4-Wire Audio Module in stations so equipped.

2. FUNCTIONS

The line driver module amplifies the output from the station receiver to a level suitable for application to the wire line between the station and the remote control point. It also contains the amplifier and switching facilities for intercommunication between a local speaker at the base station and the remote control console or desk set at the opposite end of the wire line.

Audio from the wire line is amplified before being applied to the transmitter exciter stages.

3. CIRCUIT DESCRIPTION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

a. Receiver Audio To Line

When an audio output from the receiver enters the module on pin 4 or 5, it is amplified in preamplifier stage Q3. The signal then passes through phase inverter Q4. From the phase inverter, the signal goes to line driver Q6, and amplifier Q5 through blocking capacitor C10 and attenuating resistor R17. The signal at the collector of Q5 is 180 degrees out-of-phase with the signal at the base of Q6. The out-of-phase signals are fed to line driver transistors Q6 and Q7, which then apply the amplified audio signal to the line transformer and the line.

b. Line To Transmitter Exciter

The audio signal entering the transformer on the line windings is coupled out through the tertiary winding, terminals 7 and 9, into Exciter/Speaker Amplifier stage Q9. After amplification in this stage, which is operated as an

LINE DRIVER/4-WIRE AUDIO MODULE

REVISIONS

63P81002E44-E

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8763A-1	C11	ADDED	BASE CIRCUIT OF Q4
	C12	ADDED	BASE CIRCUIT OF Q6

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN8763A Station Logic Circuit Board PL-285-A

		CAPACITOR, fixed:
C1	8D82905G05	0.15 uF ±10% 50 v
C2, 4, 6, 8	23K865136	15 uF ±20%; 25 v
C3, 9, 11, 12	21D82187B20	.001 uF ±10%; 100 v
C5	8D82905G07	0.1 uF ±10%; 50 v
C7	8D82905G11	0.22 uF ±10%; 50 v
C10	23D82783B08	1.0 uF ±20%; 35 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 7	48C82392B03	silicon; RD1343
		TRANSISTOR: (SEE NOTE)
Q1, 2	48R869539	N-P-N; M9539
Q3, 5	48R869570	N-P-N; M9570
Q4, 7	48R869571	P-N-P; M9571
Q6	48R869568	N-P-N; M9568
		RESISTOR, fixed; ±10%; 1/2 w; unl stated
R1, 18, 19	18C83083G03	variable; 25K
R2, 27	6S6048	47K
R3	6S6074	68K
R4	6S2089	1.8K
R5	6S6326	100
R6	6S6117	5.6K
R7, 25	6S6229	1K
R8, 13	6S6434	27K
R9	6S129226	100K; 1/4 w
R10	6S6069	2.2K; 1/4 w
R11	6S6393	1.2K
R12	6S5644	82K
R14, 15, 31	6S6397	22K
R16, 17, 32	6S5581	3.3K
R20	6S6291	560
R21	6S5614	56
R22	6S6038	1.5K
R23, 30	6S6090	470
R24	6S5591	18K
R26	6S127803	1.5K; 1/4 w
R29	6S6373	150
R28	6S5772	470; 1 w
R33, 34, 35, 37	6S2050	270K ±5%
R36	6S5796	560K ±5%
R38	6S115017	11K ±5%
R39	6S5789	91K ±5%
R40	6S129148	470K; 1/4 w
R41	6S128687	6.8K; 1/4 w
R42	6S129225	10K; 1/4 w
R43	6S128685	22K; 1/4 w

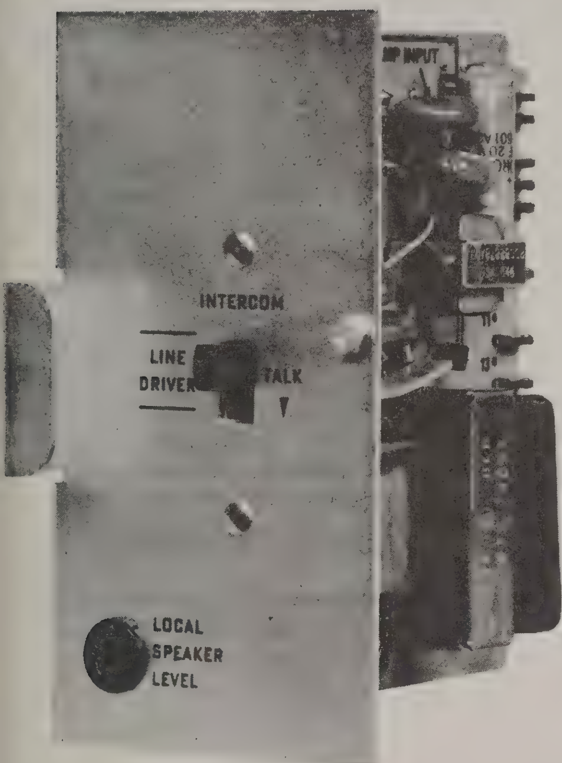
TLN8764A Station Logic Panel PL-286-O

		CONNECTOR, receptacle:
J23	9C83478E01	female; 12 contact
		SWITCH, slide:
S1	40B83204B01	dpdt

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

LINE DRIVER/4-WIRE AUDIO MODULE

MODEL TLN1172A



1. DESCRIPTION

The TLN1172A Line Driver Module is a fully transistorized, plug-in circuit module for the remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed. This module is also used as the 4-Wire Audio Module in stations so equipped.

2. FUNCTIONS

The line driver module amplifies the output from the station receiver to a level suitable for application to the wire line between the station and the remote control point. It also contains the amplifier and switching facilities for intercommunication between a local speaker at the base station and the remote control console or desk set at the opposite end of the wire line.

Audio from the wire line is amplified before being applied to the transmitter exciter stages.

3. CIRCUIT DESCRIPTION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

a. Receiver Audio To Line

When an audio output from the receiver enters the module on pin 4 or 5, it is amplified in preamplifier stage Q3. The signal then passes through phase inverter Q4. From the phase inverter, the signal goes to line driver Q6, and amplifier Q5 through blocking capacitor C10 and attenuating resistor R17. The signal at the collector of Q5 is 180 degrees out-of-phase with the signal at the base of Q6. The out-of-phase signals are fed to line driver transistors Q6 and Q7, which then apply the amplified audio signal to the line transformer and the line.

b. Line To Transmitter Exciter

The audio signal entering the transformer on the line windings is coupled out through the tertiary winding, terminals 7 and 9, into Exciter/Speaker Amplifier stage Q9. After amplification in this stage, which is operated as an

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emitter-follower, the signal is taken from the emitter and passed through jumper JU2 and pin 19 to the Station Logic Module and the transmitter exciter.

c. Intercommunication With The Remote Control Point

With the INTERCOM-TALK switch held in the TALK position, speaking into the local speaker on the base station routes the signal to intercom preamplifier stage Q2, intercom amplifier stage Q1, and through level adjustment network R1, R2, and R3. The output is adjustable by placement of a jumper for approximately +18 dBm, 0 dBm, or -8 dBm on the line. It is then applied to a phase inverter and amplifier pair which drive the line drivers. The line drivers are coupled to the line by transformer T1 and the voice message is sent over the wire line to the remote point.

The return signal on the wire line is coupled from the line side of transformer T1 through the tertiary winding to the Exciter/Speaker Amplifier and on to the SPEAKER LEVEL control. From the control, the signal passes through pin 23 to the receiver audio amplifier stages and back to the local speaker.

4. MAINTENANCE AND TROUBLESHOOTING

a. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the circuitry, remove the module, insert a Model TLN8799A Module Extension Kit, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

Servicing may be done without connection to a remote control chassis if the proper power and terminations are connected to the module. A convenient method of connection is through the use of a TEK-38 Base Station Module Servicing Adapter. The module is simply plugged into the 24 pin male plug of the adapter. Connections are then made to the circuit module via the adapter using the standard and/or resistor push on patch leads supplied with the adapter.

Make the connections shown in the following out of circuit servicing chart.

PIN NO.	CONNECT
1, 20	Ground
4	Audio oscillator through .1 uF
12	+12 volts dc
16	600 ohms to pin 17
17	AC voltmeter to pin 16
22	3.2-ohm speaker to ground

b. Module Malfunction Location Techniques

(1) Make the connections to the modules as indicated in the preceding table.

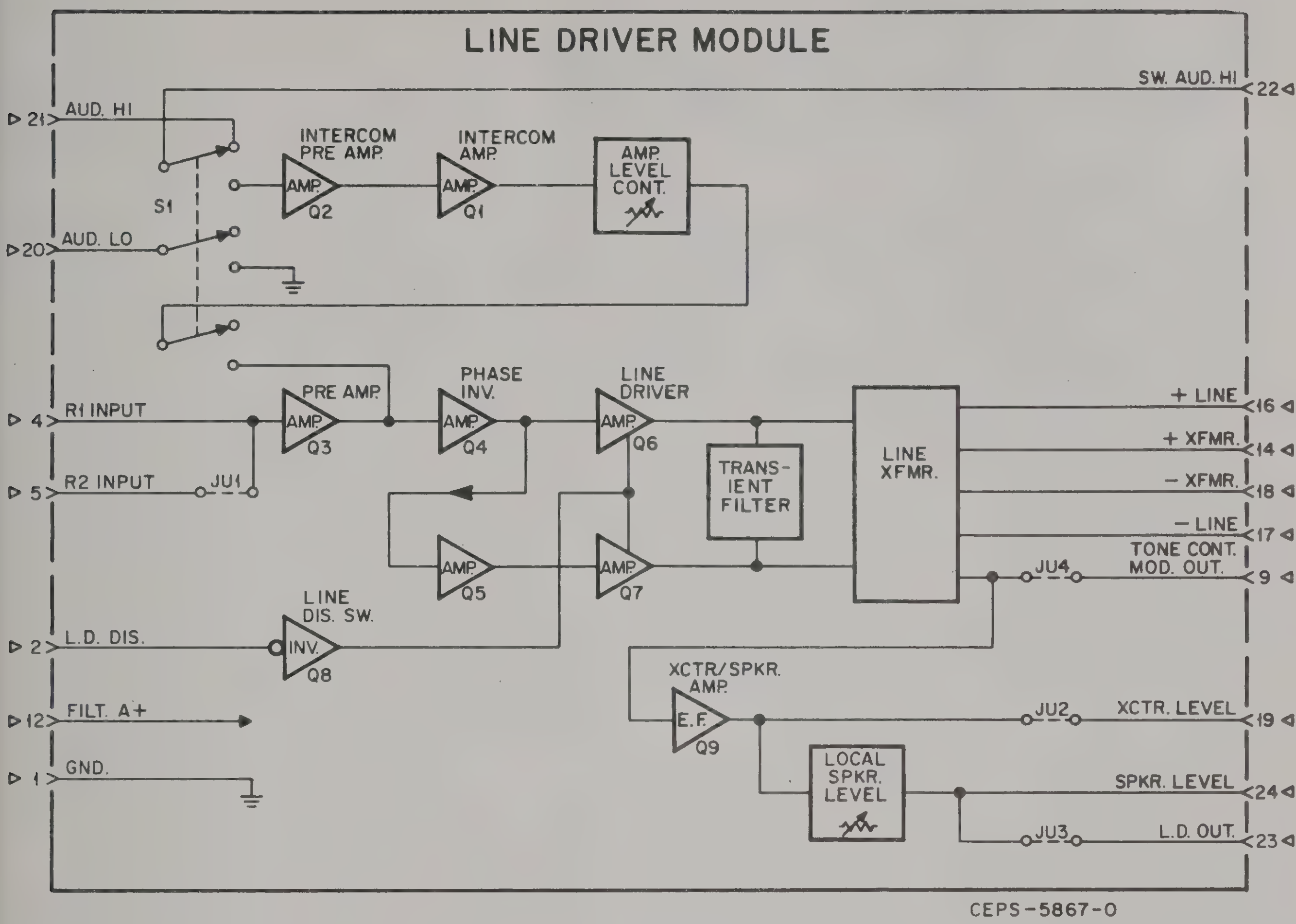
(2) Inject a 1000-Hz tone through the .1 uF capacitor into pin 4. With the tone level at -20 dBm, the voltage measured across the 600-ohm load (pins 16 and 17) should be approximately +14 dBm. If the level is much below this figure, check preamplifier stage Q3, then Phase Inverter Q4, Amplifier Q5, Line Drivers Q6 and Q7, and Line Driver Disable Switch Q8.

(3) Apply a ground to pin 2. The output measured at the 600-ohm load should drop to zero. If this does not occur, investigate diode CR7 and components of the Line Driver Disable Switch stage.

(4) With the same audio input as before, the output measured at pin 19 should be +8 dBm, or 6 dB below the previously measured line output. If the appropriate level cannot be obtained, check Exciter/Speaker Amplifier stage Q9.

(5) Move the INTERCOM-TALK switch to the TALK position. Note the position of the AMP LEVEL jumper on the circuit board. Whistle loudly into the speaker connected to the module. The voltmeter connected to the load on pins 16 and 17 should peak at the level selected by the AMP LEVEL jumper (-8, 0, +18 dBm). If difficulty is experienced, check Intercom Amplifier stage Q1 or Intercom Preamplifier stage Q2.

(6) Remove the resistive load from pins 16 and 17. Check to see that continuity does not exist between these pins. If continuity is indicated check for a shorted capacitor (C16).



Functional Block Diagram

LINE DRIVER/4-WIRE AUDIO MODULE

MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX	DESCRIPTION
TLN1172A		TLN8761A		LINE DRIVER BOARD
		TLN8762A		LINE DRIVER MODULE

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K=1000)
   CAPACITOR VALUES ARE IN MICROFARADS
2. AT POINTS SHOWING TWO VOLTAGE READINGS THE TOP VALUE (IN PARENTHESIS) IS FOR THE TRANSMIT CONDITION AND THE BOTTOM VALUE IS FOR THE RECEIVE OR STANDBY CONDITIONS.
3. THE "AMP LEVEL" JUMPER CONNECTS TO ONE OF THE THREE POINTS $\boxed{-8}$, $\boxed{0}$ OR $\boxed{+18}$ TO SELECT DESIRED INTERCOM TALK LEVEL.
4. JUMPER TABLE (FOR DC AND TONE REMOTES).

APPLICATION	JU1	JU2	JU3	JU4
BASE STATION WITH ONE RECEIVER: 2-WIRE AUDIO	OUT	IN	IN	IN
BASE STATION WITH TWO RECEIVERS: 2-WIRE AUDIO	IN *	IN	IN	IN
BASE STATION WITH ONE RECEIVER: 4-WIRE AUDIO (LINE DRIVER MODULE)	OUT	OUT	IN	OUT
BASE STATION WITH ONE RECEIVER: 4-WIRE AUDIO (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN
BASE STATION WITH TWO RECEIVERS: 4-WIRE AUDIO, BOTH RECEIVERS ON SAME LINE (LINE DRIVER MODULE)	IN *	OUT	IN	OUT
BASE STATIONS WITH TWO RECEIVERS: 4-WIRE AUDIO; BOTH RECEIVERS ON SAME LINE (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN
BASE STATIONS WITH TWO RECEIVERS: 4-WIRE AUDIO; RECEIVERS ON SEPARATE LINES (LINE DRIVER MODULE)	OUT	OUT **	IN	OUT **
BASE STATIONS WITH TWO RECEIVERS: 4-WIRE AUDIO; RECEIVERS ON SEPARATE LINES (4-WIRE AUDIO MODULE)	IN	IN *	OUT	IN *
REPEATER (RT) STATION WITH WIRE LINE CONTROL: 2-WIRE AUDIO	OUT	IN	IN	IN
BASE (RA) STATION 2-WIRE AUDIO	OUT	IN	IN	IN
BASE (RA) STATION: 4-WIRE AUDIO (LINE DRIVER MODULE)	OUT	OUT	IN	OUT
BASE (RA) STATION: 4-WIRE AUDIO (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN
REPEATER (RA) STATION: 2-WIRE AUDIO	OUT	IN	IN	IN
REPEATER (RA) STATION: 4-WIRE AUDIO (LINE DRIVER MODULE)	OUT	OUT	IN	OUT
REPEATER (RA) STATION: 4-WIRE AUDIO (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN

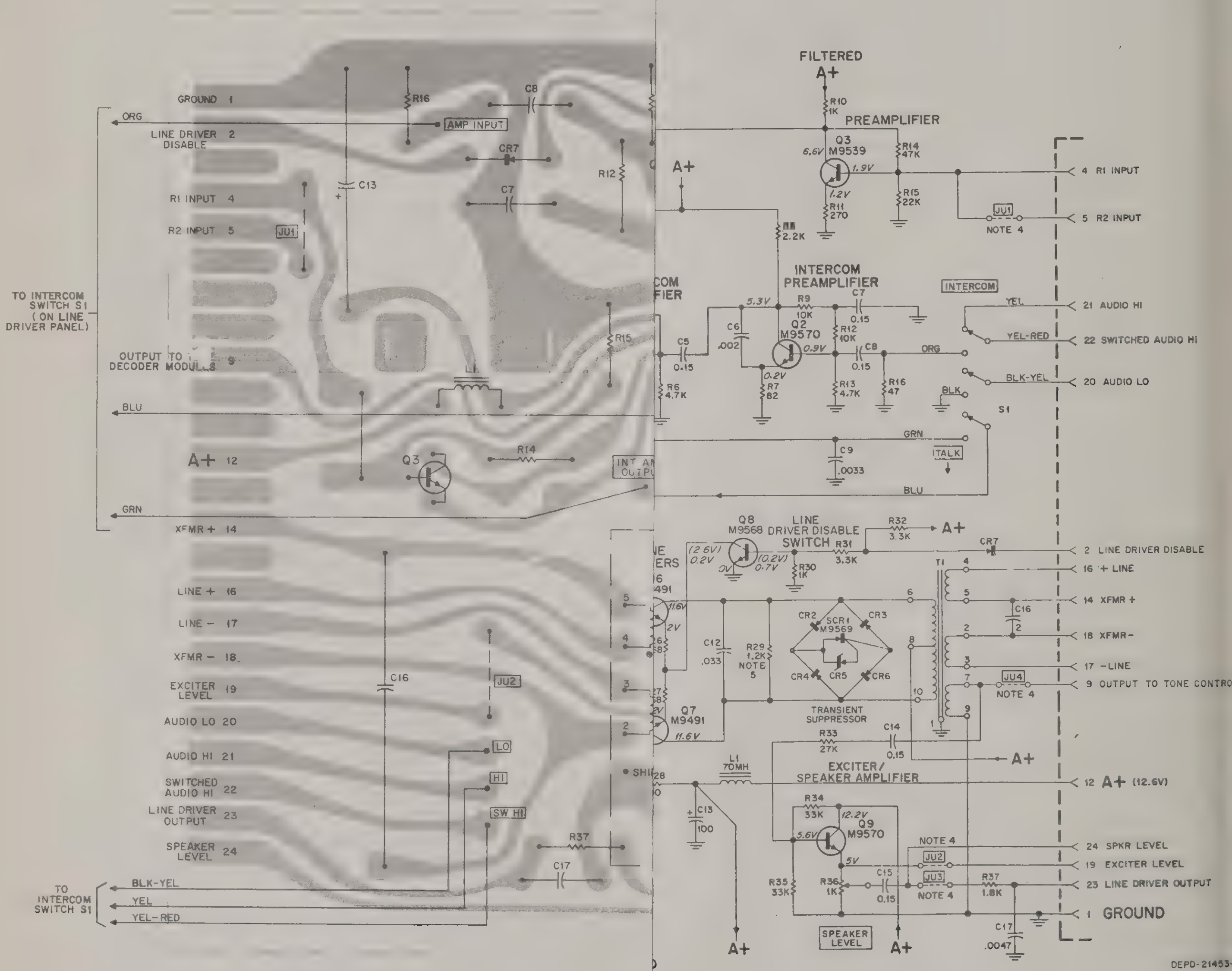
*OUT IN TONE REMOTE CONTROL STATIONS.
**IN ON TONE REMOTE CONTROL STATIONS.

5. WHEN MORE THAN ONE BASE STATION IS IN PARALLEL ACROSS A SINGLE LINE, R29 SHOULD BE REMOVED FROM ALL LINE DRIVER MODULES EXCEPT ONE (ANY ONE).

EPS-1737-C

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLN1172A Line Driver Module
Or 4-Wire Audio Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81002E43-C
3/1/72-UP



TO INTERCOM SWITCH S1 (ON LINE DRIVER PANEL)
GROUND 1
LINE DRIVER DISABLE 2
R1 INPUT 4
R2 INPUT 5
OUTPUT TO DECODER MODULES 9
A+ 12
XFMR + 14
LINE + 16
LINE − 17
XFMR − 18
EXCITER LEVEL 19
AUDIO LO 20
AUDIO HI 21
SWITCHED AUDIO HI 22
LINE DRIVER OUTPUT 23
SPEAKER LEVEL 24
TO INTERCOM SWITCH S1
ORG
BLU
GRN
BLK-YEL
YEL
YEL-RED
AMP INPUT
JU1
JU2
LO
HI
SW HI
FILTERED A+
PREAMPLIFIER
Q3 M9539
INTERCOM PREAMPLIFIER
Q2 M9570
INTERCOM
S1
ITALK
Q8 M9568 LINE DRIVER DISABLE SWITCH
TRANSIENT SUPPRESSOR
SCR1 M9569
Q7 M9491
EXCITER/ SPEAKER AMPLIFIER
Q9 M9570
L1 70MH
NOTE 4
NOTE 5
SPEAKER LEVEL
4 R1 INPUT
5 R2 INPUT
21 AUDIO HI
22 SWITCHED AUDIO HI
20 AUDIO LO
2 LINE DRIVER DISABLE
16 + LINE
14 XFMR +
18 XFMR−
17 −LINE
9 OUTPUT TO TONE CONTRO
12 A+ (12.6V)
24 SPKR LEVEL
19 EXCITER LEVEL
23 LINE DRIVER OUTPUT
1 GROUND
DEPD-21453-

MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX	DESCRIPTION
TLN1172A		TLN8761A		LINE DRIVER BOARD
		TLN8762A		LINE DRIVER MODULE

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K=1000)
   CAPACITOR VALUES ARE IN MICROFARADS
2. AT POINTS SHOWING TWO VOLTAGE READINGS THE TOP VALUE (IN PARENTHESIS) IS FOR THE TRANSMIT CONDITION AND THE BOTTOM VALUE IS FOR THE RECEIVE OR STANDBY CONDITIONS.
3. THE "AMP LEVEL" JUMPER CONNECTS TO ONE OF THE THREE POINTS $\boxed{-8}$, $\boxed{0}$ OR $\boxed{+18}$ TO SELECT DESIRED INTERCOM TALK LEVEL.
4. JUMPER TABLE (FOR DC AND TONE REMOTES).

APPLICATION	JU1	JU2	JU3	JU4
BASE STATION WITH ONE RECEIVER: 2-WIRE AUDIO	OUT	IN	IN	IN
BASE STATION WITH TWO RECEIVERS: 2-WIRE AUDIO	IN *	IN	IN	IN
BASE STATION WITH ONE RECEIVER: 4-WIRE AUDIO (LINE DRIVER MODULE)	OUT	OUT	IN	OUT
BASE STATION WITH ONE RECEIVER: 4-WIRE AUDIO (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN
BASE STATION WITH TWO RECEIVERS: 4-WIRE AUDIO, BOTH RECEIVERS ON SAME LINE (LINE DRIVER MODULE)	IN *	OUT	IN	OUT
BASE STATIONS WITH TWO RECEIVERS: 4-WIRE AUDIO; BOTH RECEIVERS ON SAME LINE (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN
BASE STATIONS WITH TWO RECEIVERS: 4-WIRE AUDIO; RECEIVERS ON SEPARATE LINES (LINE DRIVER MODULE)	OUT	OUT **	IN	OUT **
BASE STATIONS WITH TWO RECEIVERS: 4-WIRE AUDIO; RECEIVERS ON SEPARATE LINES (4-WIRE AUDIO MODULE)	IN	IN *	OUT	IN *
REPEATER (RT) STATION WITH WIRE LINE CONTROL: 2-WIRE AUDIO	OUT	IN	IN	IN
BASE (RA) STATION 2-WIRE AUDIO	OUT	IN	IN	IN
BASE (RA) STATION: 4-WIRE AUDIO (LINE DRIVER MODULE)	OUT	OUT	IN	OUT
BASE (RA) STATION: 4-WIRE AUDIO (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN
REPEATER (RA) STATION: 2-WIRE AUDIO	OUT	IN	IN	IN
REPEATER (RA) STATION: 4-WIRE AUDIO (LINE DRIVER MODULE)	OUT	OUT	IN	OUT
REPEATER (RA) STATION: 4-WIRE AUDIO (4-WIRE AUDIO MODULE)	OUT	IN	OUT	IN

*OUT IN TONE REMOTE CONTROL STATIONS.
**IN ON TONE REMOTE CONTROL STATIONS.

5. WHEN MORE THAN ONE BASE STATION IS IN PARALLEL ACROSS A SINGLE LINE, R29 SHOULD BE REMOVED FROM ALL LINE DRIVER MODULES EXCEPT ONE (ANY ONE).

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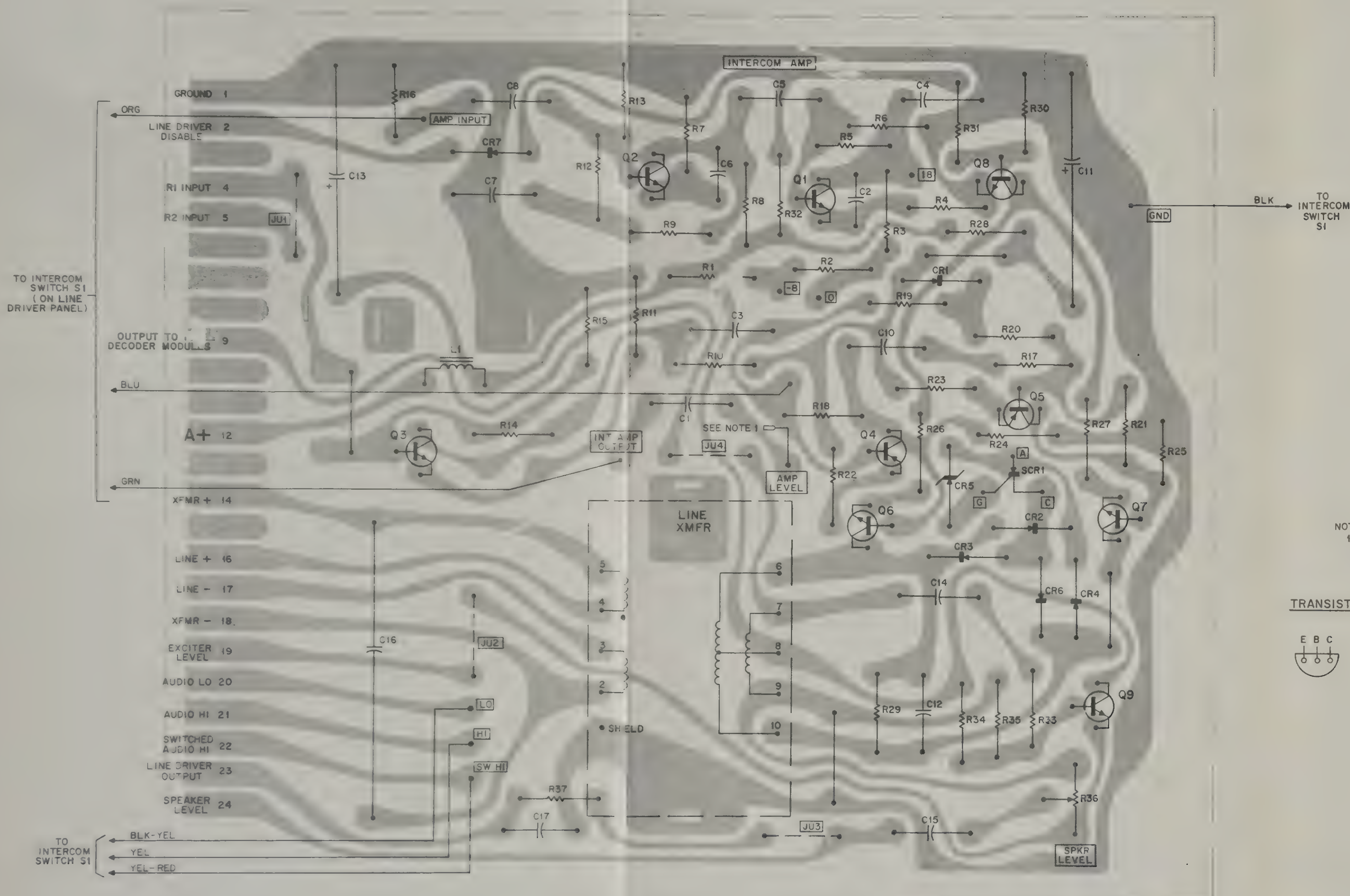
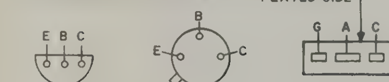
PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

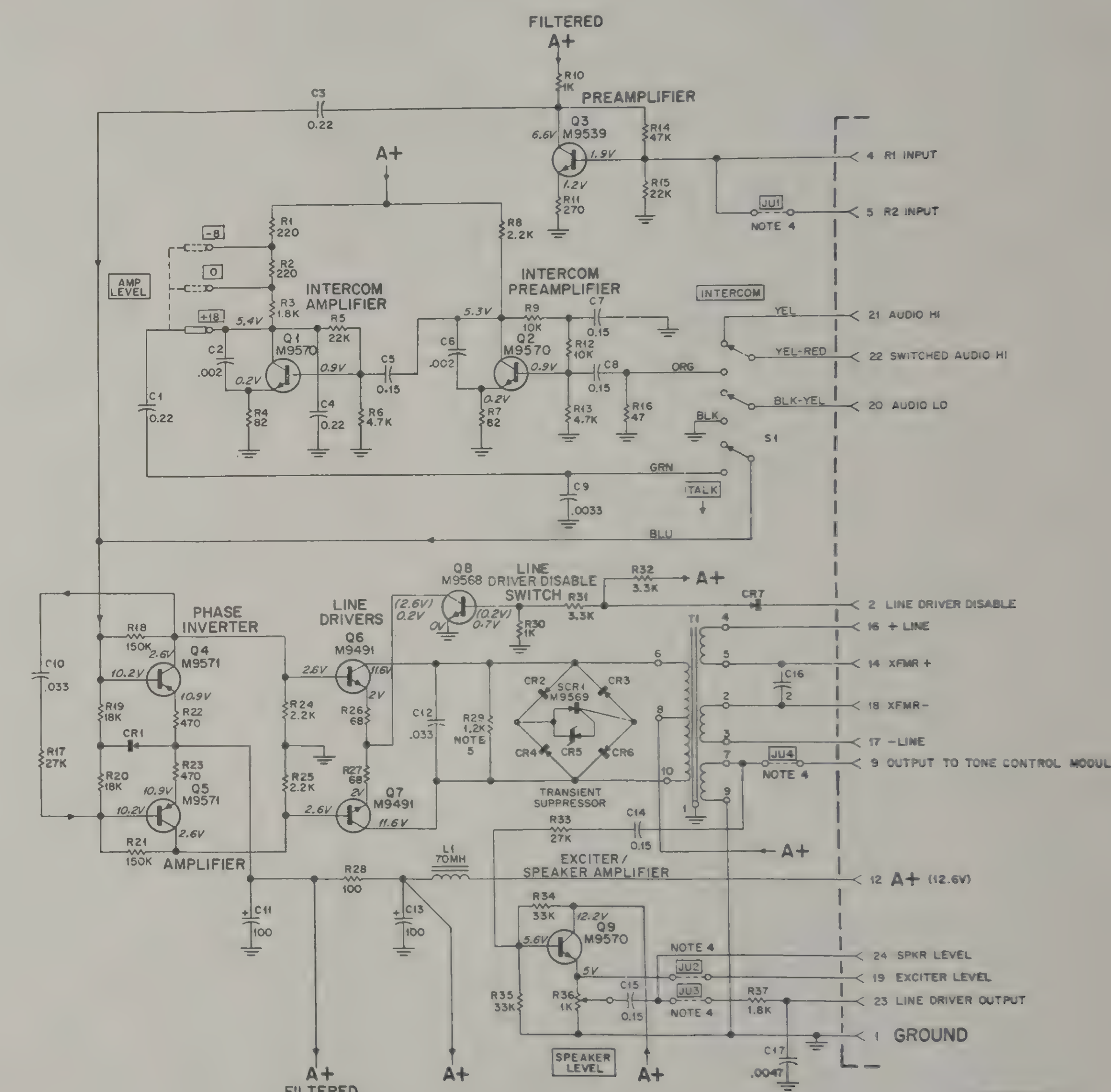
TLN1172A Line Driver Module
Or 4-Wire Audio Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81002E43-C
3/1/72-UP



NOTE:
1. AMP LEVEL JUMPER CONNECTS TO ONE OF THE THREE POINTS: +18, 0, OR −8.

TRANSISTOR DETAILS:





TIME-OUT TIMER

MODEL TLN1179A

1. DESCRIPTION

The Time-Out Timer Module is used to limit transmission time. For base stations and (RA) repeaters, it limits the continuous transmission time. For repeaters, it limits the transmission time of individual users but not the period of continuous transmission that would occur if it was keyed during the turn-off delay. The unit can be preset for 1/2, 1, 2, 4, or 8 minutes operation.

2. CIRCUIT DESCRIPTION

Refer to the attached Time-Out Timer Module Schematic Diagram. Either JU1 or JU2 (but not both) is connected according to the table in NOTE 2. This allows the Time-Out Timer Module to operate for a time-out timer reset input or a push-to-talk input, whichever is applicable and prevents transmission beyond its preset timing period of 1/2, 1, 2, 4, or 8 minutes. The timing cycle starts when transmission occurs. At this time, a switched ground input is applied to the time-out timer reset stage. This switch stage is turned on and applies a switched A+ to all other stages of the Time-Out Timer Module.

Application of switched A+ starts the master timing generator, which is an astable multivibrator that operates at 15 seconds per cycle. The transistor and capacitors in this stage are specially selected for low leakage and must be replaced by low leakage components to retain the 15 second cycle. As shown in the waveform chart, the output section starts in the saturated condition and reverses every 7-1/2 seconds.

The time multipliers are identical bistable multivibrators. Each one starts with its output section saturated and reverses its condition only by application of a negative-going signal. The diodes in the base circuits of both sections block positive-going signals. The input is applied to both sections of the multivibrator so that each negative-going input reverses the state of the output, regardless of the previous state. Therefore, the output of each time multiplier is at one half the rate of its input.

The time-out storage stage is also a bistable multivibrator, but has an input to only one section. It acts as a driver for the inhibit switch. At the start of the time-out cycle, the output section (which has its output coupled to the inhibit switch) is saturated and the collector voltage is low. The input to the time-out storage stage is connected to any of the time multipliers, depending upon the desired time-out period. When the time multiplier to which the time-out storage input is connected produces a negative-going pulse, the time-out storage bistable will reverse states. The high collector voltage output will saturate the inhibit switch and provide a switched ground output.

The switched ground output turns off the transmitter. When the input is removed from the time-out timer reset stage, this stage cuts off and switched A+ is removed from all stages. As a result, the switched ground output is removed. When the input is again applied, the timer is instantly reset and another timing cycle starts.

3. TROUBLESHOOTING

If the troubleshooting procedure for the station indicates that the Time-Out Timer Module is defective, the troubleshooting chart should be followed to locate the defective stage. When the defective stage is located, dc voltage and

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PARTS LIST

TLN8761A Line Driver Board PL-253-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; unl stated
C1, 3, 4	8D82905G11	.22; 50 v
C2, 6	21D82428B25	.002 ±20%; 500 v
C5, 7, 8, 14, 15	8D82905G05	0.15; 50 v
C10, 12	8D82905G08	.033; 50 v
C11, 13	23D82601A25	100 +150-10%; 20 v
C16	8D82045F05	2; 350 v
C17, 33	8D82905G26	.0047; 100 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 7	48C82392B03	silicon; RD1343
CR2, 3, 4, 6	48C82466H01	silicon
CR5	48D82256C20	zener type; 27 v
		COIL, choke:
L1	25B82878A03	70 mH
		TRANSISTOR: (SEE NOTE)
Q1, 2, 9	48R869570	N-P-N; M9570
Q3	48R869539	N-P-N; M9539
Q4, 5	48R869471	P-N-P; M9471
Q6, 7	48R869491	N-P-N; M9491
Q8	48R869568	N-P-N; M9568
		RESISTOR, fixed: ±10%; 1/4 w;
R1, 2	6S127800	220
R3, 37	6S129269	1.8K
R4, 7	6S129224	82
R5, 15	6S128685	22K
R6, 13	6S127804	4.7K
R8,	6S128689	2.2K
R9, 12	6S129225	10K
R10, 30	6S127802	1K
R11	6S129752	270
R14	6S128902	47K
R16	6S129233	47
R17, 33	6S127806	27K
R18, 21	6S128683	150K ±5%
R19, 20	6S131526	18K ±5%
R22, 23	6S127801	470
R24, 25	6S129804	2.2K ±5%
R26, 27	6S129861	68
R28	6S129753	100
R29	6S129235	1.2K
R31, 32	6S129231	3.3K
R34, 35	6S127807	33K
R36	18C83083G04	variable: 1K ±30%
		RECTIFIER:
SCR1	48R869569	silicon controlled; M9569
		TRANSFORMER, line-driver:
T1	25C83000H01	pri: No. 1; term. 2 & 3; 150 ohms; No. 2; term. 4 & 5; 150 ohms; sec; No. 1; term. 6 & 10 w/8 tap; total res. 1.2K ohms; No. 2; term. 7 & 9; 600 ohms
		NON-REFERENCED ITEMS
	9B83011H01	RECEPTACLE, board mtg: 17 req'd.
	9A83445D01	PIN, terminal: 3 req'd.

TLN8762A Line Driver Panel PL-354-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C9	21D82428B10	.0033 uF ±10%; 100 v
		SWITCH, slide:
S1	40B83881C01	3 pdt
		NON-REFERENCED ITEMS
	1V80781A47	PANEL ASSY, (riveted) incl. ref. part S1
	43B82721C01	BUSHING, insulator
	45B83914G01	GUIDE, printed circuit board
	46B83284H01	PLUG, keying

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TIME-OUT TIMER

MODEL TLN1179A

1. DESCRIPTION

The Time-Out Timer Module is used to limit transmission time. For base stations and (RA) repeaters, it limits the continuous transmission time. For repeaters, it limits the transmission time of individual users but not the period of continuous transmission that would occur if it was keyed during the turn-off delay. The unit can be preset for 1/2, 1, 2, 4, or 8 minutes operation.

2. CIRCUIT DESCRIPTION

Refer to the attached Time-Out Timer Module Schematic Diagram. Either JU1 or JU2 (but not both) is connected according to the table in NOTE 2. This allows the Time-Out Timer Module to operate for a time-out timer reset input or a push-to-talk input, whichever is applicable and prevents transmission beyond its preset timing period of 1/2, 1, 2, 4, or 8 minutes. The timing cycle starts when transmission occurs. At this time, a switched ground input is applied to the time-out timer reset stage. This switch stage is turned on and applies a switched A+ to all other stages of the Time-Out Timer Module.

Application of switched A+ starts the master timing generator, which is an astable multivibrator that operates at 15 seconds per cycle. The transistor and capacitors in this stage are specially selected for low leakage and must be replaced by low leakage components to retain the 15 second cycle. As shown in the waveform chart, the output section starts in the saturated condition and reverses every 7-1/2 seconds.

The time multipliers are identical bistable multivibrators. Each one starts with its output section saturated and reverses its condition only by application of a negative-going signal. The diodes in the base circuits of both sections block positive-going signals. The input is applied to both sections of the multivibrator so that each negative-going input reverses the state of the output, regardless of the previous state. Therefore, the output of each time multiplier is at one half the rate of its input.

The time-out storage stage is also a bistable multivibrator, but has an input to only one section. It acts as a driver for the inhibit switch. At the start of the time-out cycle, the output section (which has its output coupled to the inhibit switch) is saturated and the collector voltage is low. The input to the time-out storage stage is connected to any of the time multipliers, depending upon the desired time-out period. When the time multiplier to which the time-out storage input is connected produces a negative-going pulse, the time-out storage bistable will reverse states. The high collector voltage output will saturate the inhibit switch and provide a switched ground output.

The switched ground output turns off the transmitter. When the input is removed from the time-out timer reset stage, this stage cuts off and switched A+ is removed from all stages. As a result, the switched ground output is removed. When the input is again applied, the timer is instantly reset and another timing cycle starts.

3. TROUBLESHOOTING

If the troubleshooting procedure for the station indicates that the Time-Out Timer Module is defective, the troubleshooting chart should be followed to locate the defective stage. When the defective stage is located, dc voltage and

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resistance measurements should be checked to isolate the defective component. Set up the module for testing and troubleshooting as follows:

a. Remove the module from the chassis.

b. Connect a dc power supply across pins 1 and 12 with ground at pin 1. Connect a 5K resistor across pins 4 and 12. Connect either pin 6 or pin 22 (whichever is jumpered) through a means of switching to ground on the power supply. Set the power supply to 13.5 volts dc.

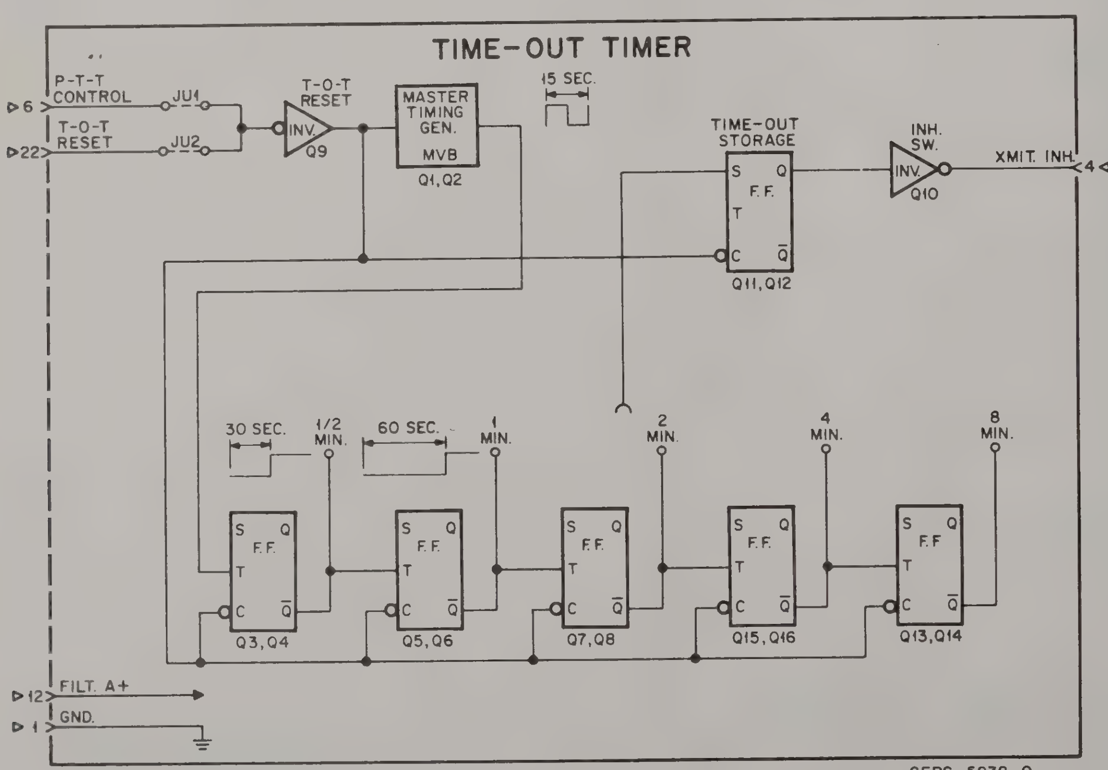
c. Refer to the attached schematic diagram and chart and note the desired timing cycle for different stages of the module. Follow the steps on the troubleshooting chart and use a watch to compare "highs" and "lows" on a VACUUM TUBE voltmeter with desired timing. Timing should be accurate ±10%.

d. If a defective stage is not located, check connections and continuity of plating for opens and shorts.

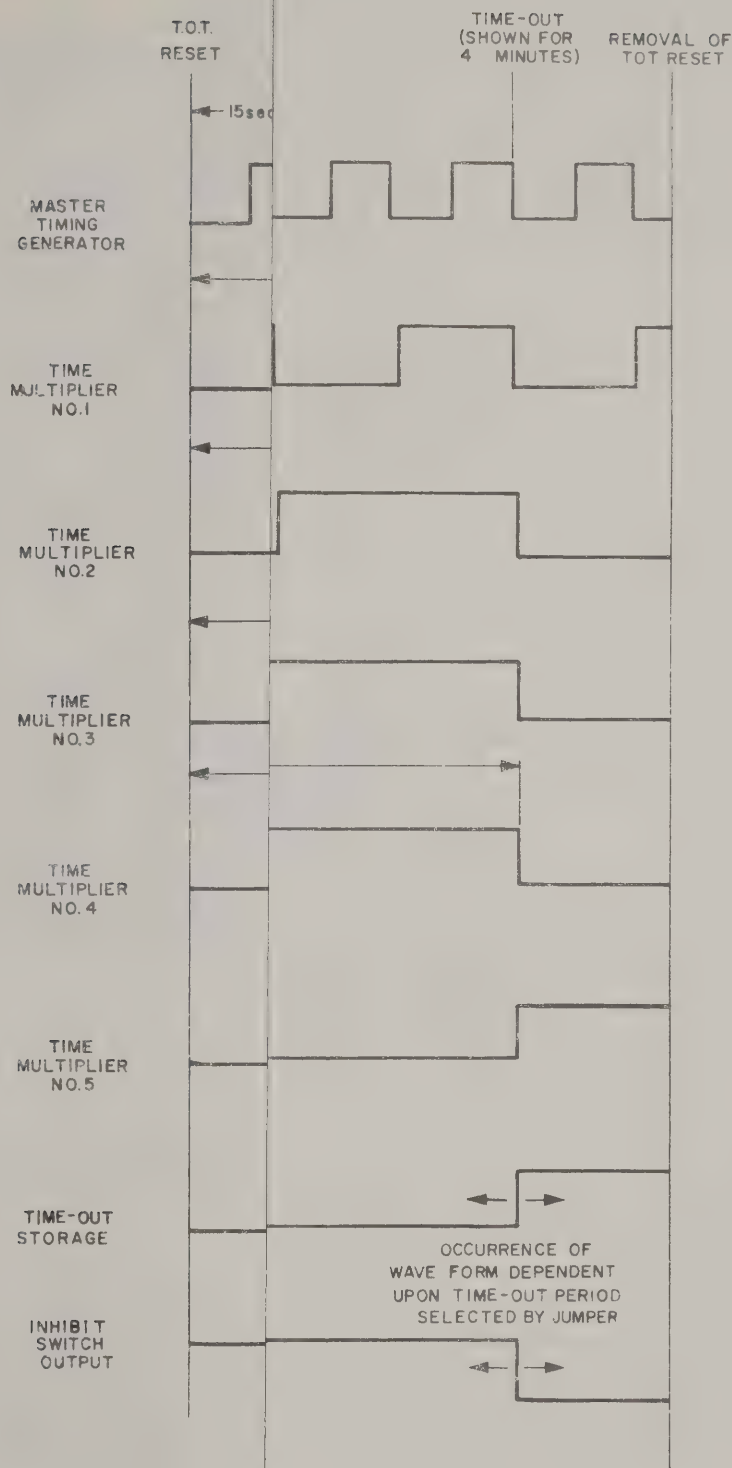
4. SPECIAL JUMPER INFORMATION

When JU-1 is used and JU-2 is out, the timer is driven by the transmitter push-to-talk (P-T-T) signal. As long as the station is keyed by any means (rf or wire line control), the timer is activated and will limit transmissions to the selected period. In repeater applications, as long as the station remains keyed by an rf carrier (even during the drop-out delay of the squelch gate), the timer continues to time out. Therefore, mobile-to-mobile communications through the repeater may exceed the selected time-out period and the station will cease to function as a repeater, even though no single mobile transmission exceeds the time-out period.

When JU-2 is used and JU-1 is out, the timer is driven from the squelch gate only. This configuration is useful only in repeater applications. However, the timer does not limit transmissions of repeater stations that are keyed via wire line control. When keyed as a repeater by the squelch gate, the timer begins to time out. However, if the squelch gate senses loss of quieting (even momentarily as it will at the end of a mobile transmission), it will reset the timer and the next carrier signal will start it on a new timing cycle. This is true even if the station remains keyed continuously due to the drop-out delay of the squelch gate. It therefore will limit transmission time of a particular user attempting to keep the station keyed for an extended period of time. It will not limit transmissions through the repeater as long as any one user does not exceed the selected time-out period. This is the recommended type of operation for most repeater applications, particularly community repeaters.



Functional Block Diagram


T.O.T.
RESET
15sec
TIME-OUT
(SHOWN FOR
4 MINUTES)
REMOVAL OF
TOT RESET
MASTER
TIMING
GENERATOR
TIME
MULTIPLIER
NO.1
TIME
MULTIPLIER
NO.2
TIME
MULTIPLIER
NO.3
TIME
MULTIPLIER
NO.4
TIME
MULTIPLIER
NO.5
TIME-OUT
STORAGE
OCCURRENCE OF
WAVE FORM DEPENDENT
UPON TIME-OUT PERIOD
SELECTED BY JUMPER
INHIBIT
SWITCH
OUTPUT

resistance measurements should be checked to isolate the defective component. Set up the module for testing and troubleshooting as follows:

a. Remove the module from the chassis.

b. Connect a dc power supply across pins 1 and 12 with ground at pin 1. Connect a 5K resistor across pins 4 and 12. Connect either pin 6 or pin 22 (whichever is jumpered) through a means of switching to ground on the power supply. Set the power supply to 13.5 volts dc.

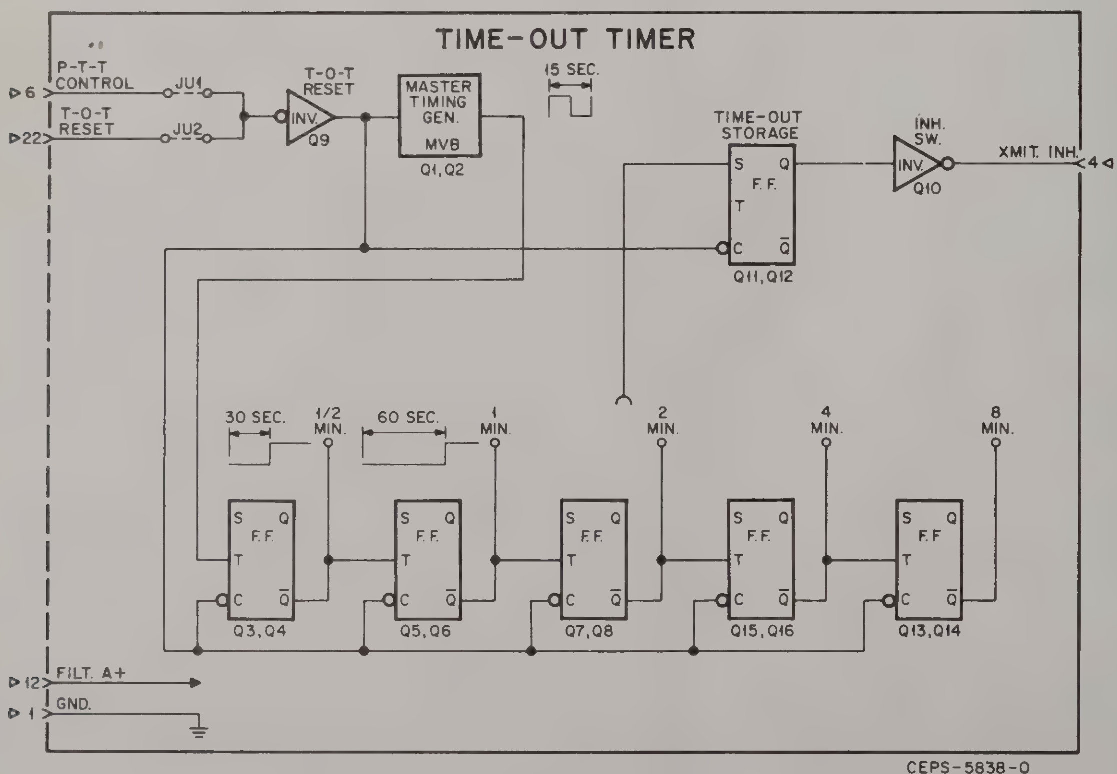
c. Refer to the attached schematic diagram and chart and note the desired timing cycle for different stages of the module. Follow the steps on the troubleshooting chart and use a watch to compare "highs" and "lows" on a VACUUM TUBE voltmeter with desired timing. Timing should be accurate ±10%.

d. If a defective stage is not located, check connections and continuity of plating for opens and shorts.

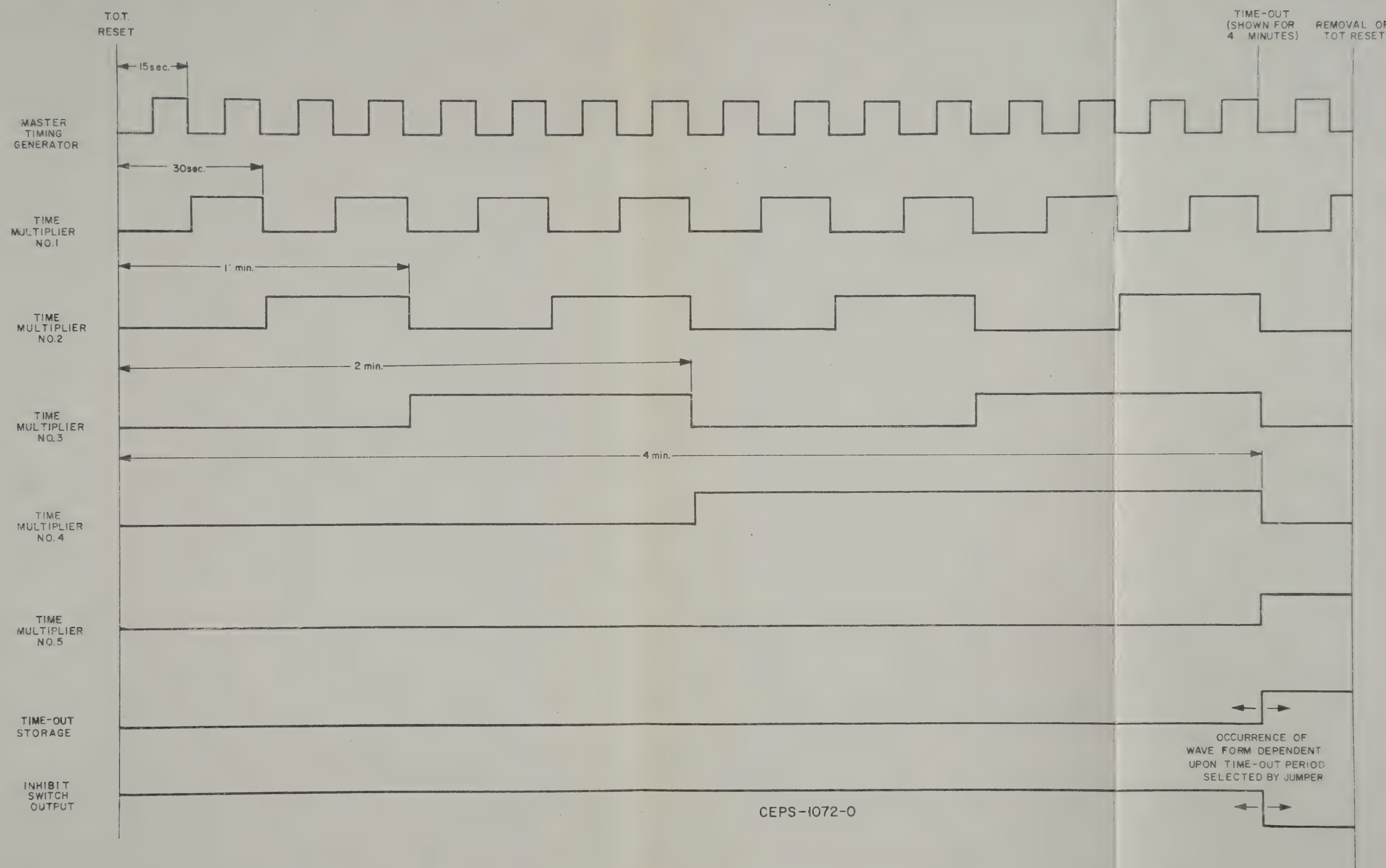
4. SPECIAL JUMPER INFORMATION

When JU-1 is used and JU-2 is out, the timer is driven by the transmitter push-to-talk (P-T-T) signal. As long as the station is keyed by any means (rf or wire line control), the timer is activated and will limit transmissions to the selected period. In repeater applications, as long as the station remains keyed by an rf carrier (even during the drop-out delay of the squelch gate), the timer continues to time out. Therefore, mobile-to-mobile communications through the repeater may exceed the selected time-out period and the station will cease to function as a repeater, even though no single mobile transmission exceeds the time-out period.

When JU-2 is used and JU-1 is out, the timer is driven from the squelch gate only. This configuration is useful only in repeater applications. However, the timer does not limit transmissions of repeater stations that are keyed via wire line control. When keyed as a repeater by the squelch gate, the timer begins to time out. However, if the squelch gate senses loss of quieting (even momentarily as it will at the end of a mobile transmission), it will reset the timer and the next carrier signal will start it on a new timing cycle. This is true even if the station remains keyed continuously due to the drop-out delay of the squelch gate. It therefore will limit transmission time of a particular user attempting to keep the station keyed for an extended period of time. It will not limit transmissions through the repeater as long as any one user does not exceed the selected time-out period. This is the recommended type of operation for most repeater applications, particularly community repeaters.

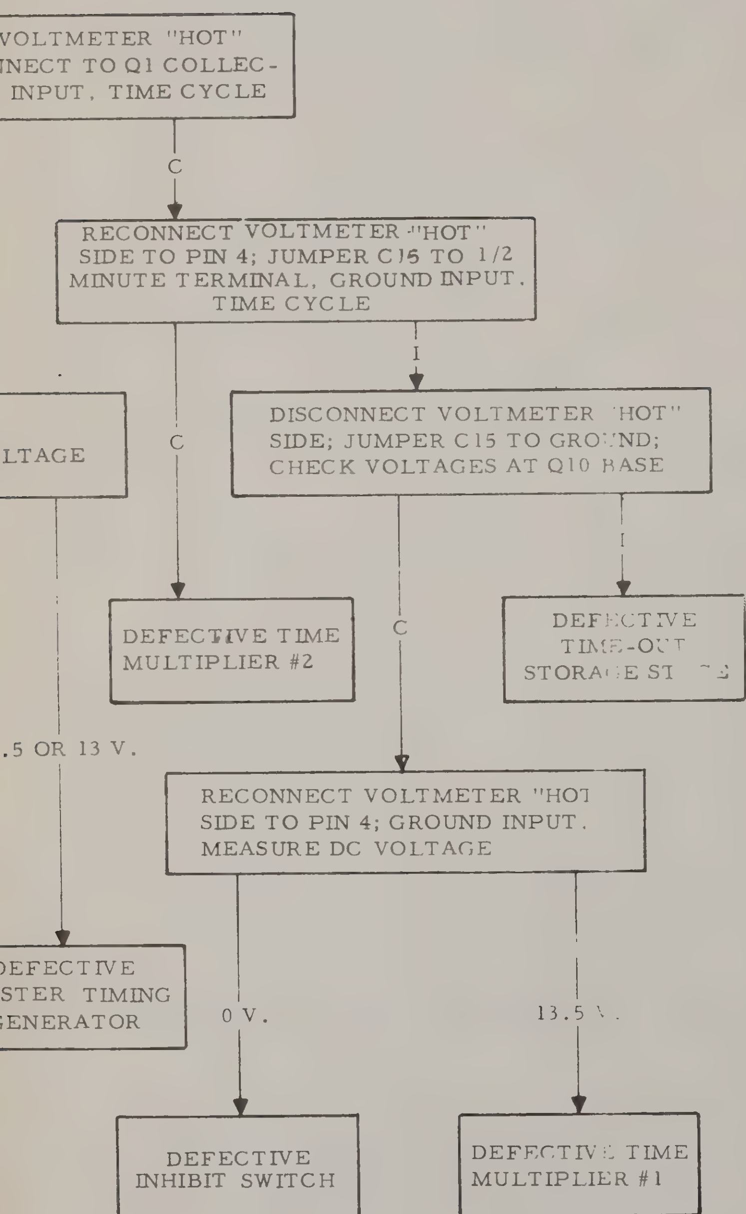


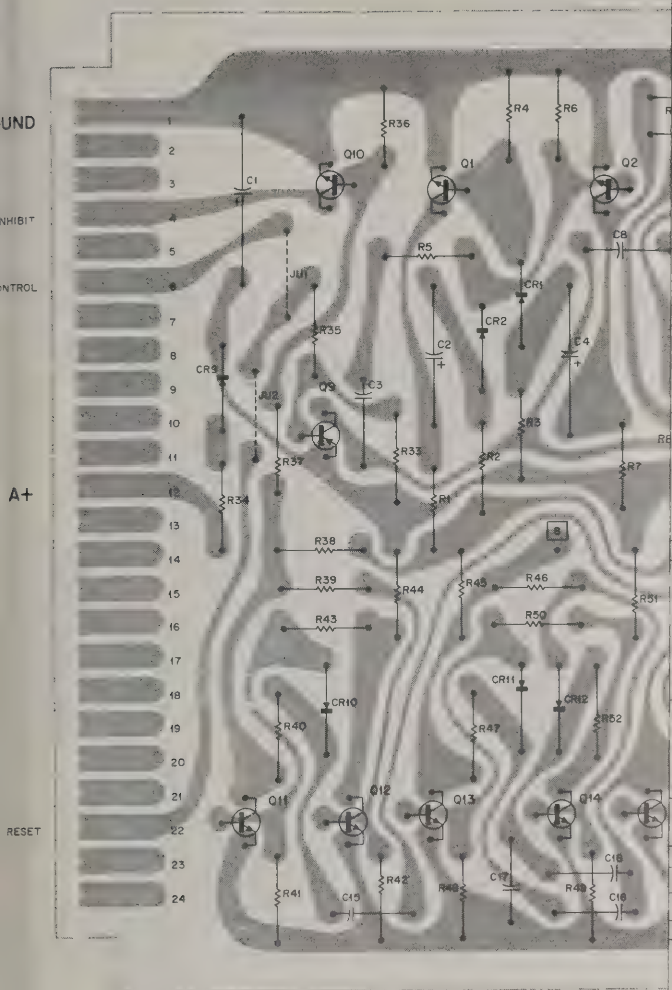
Functional Block Diagram

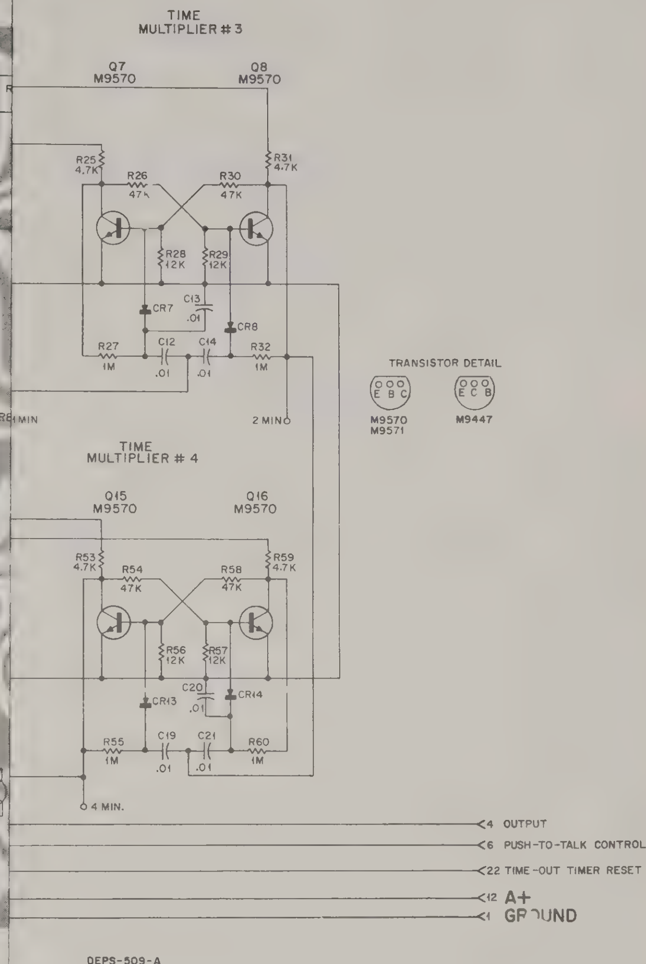

T.O.T. RESET
TIME-OUT (SHOWN FOR 4 MINUTES)
REMOVAL OF TOT RESET
15sec.
MASTER TIMING GENERATOR
30sec.
TIME MULTIPLIER NO.1
1 min.
TIME MULTIPLIER NO.2
2 min.
TIME MULTIPLIER NO.3
4 min.
TIME MULTIPLIER NO.4
TIME MULTIPLIER NO.5
TIME-OUT STORAGE
OCCURRENCE OF WAVE FORM DEPENDENT UPON TIME-OUT PERIOD SELECTED BY JUMPER
INHIBIT SWITCH OUTPUT

CEPS-1072-0

HOOTING CHART







DEPS-509-A

MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX
TLN1179A		TLN8769A	
		TLN8770A	

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K=1000)
   CAPACITOR VALUES ARE IN MICROFARADS.
2. JUMPER TABLE

APPLICATION	JU1*	JU2
BASE STATION	IN	OU
REPEATER (RT)	OUT	IN
BASE (RA) STATION	IN	OU
REPEATER (RA) STATION	IN	OU
COMMUNITY REPEATER	OUT	IN

*SEE SPECIAL JUMPER INFORMATION IN TEXT.

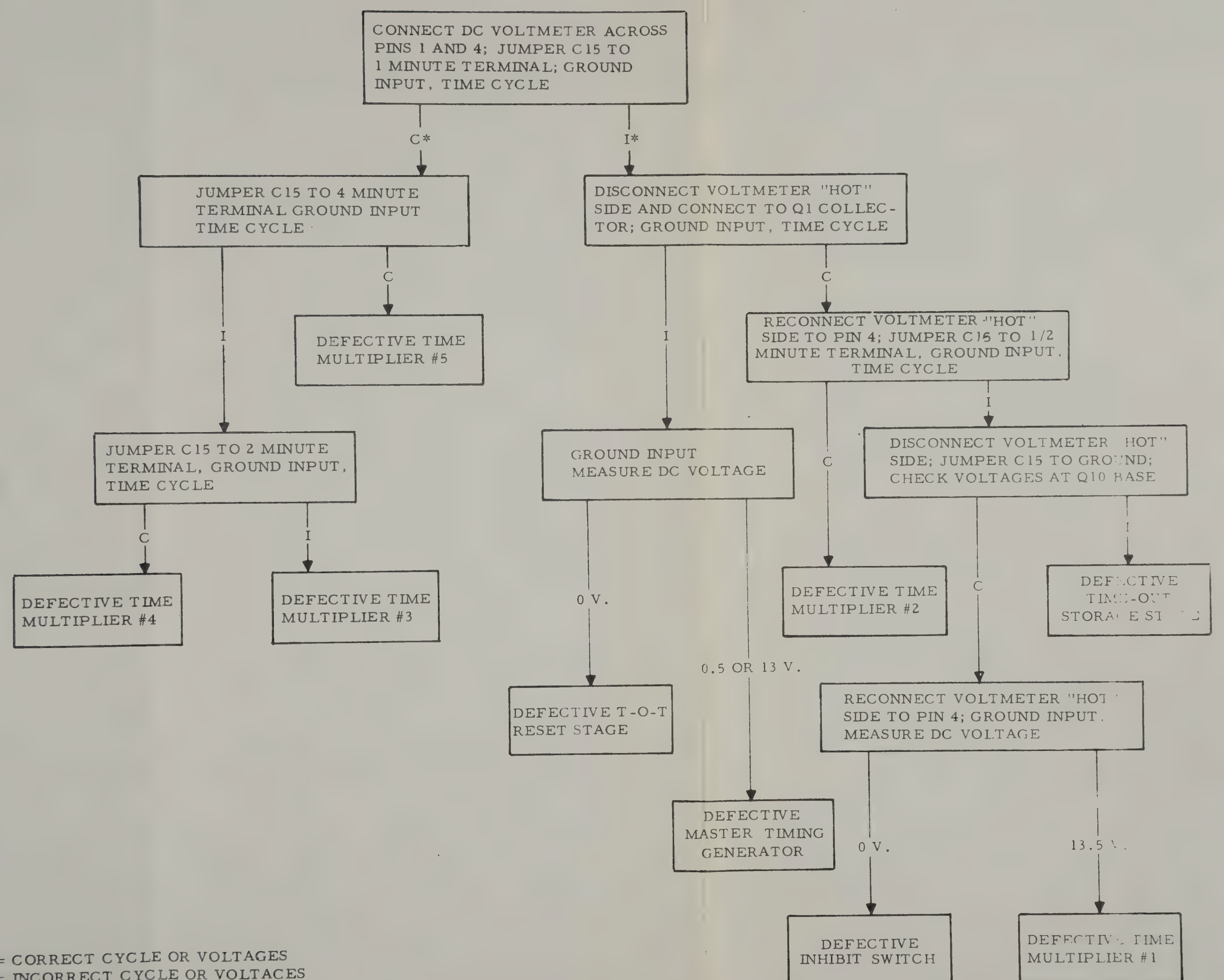
TIME-OUT TIMER

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLN1179A Time-Out Timer Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81001E13-B
3/1/72-UP

TIME-OUT TIMER TROUBLESHOOTING CHART

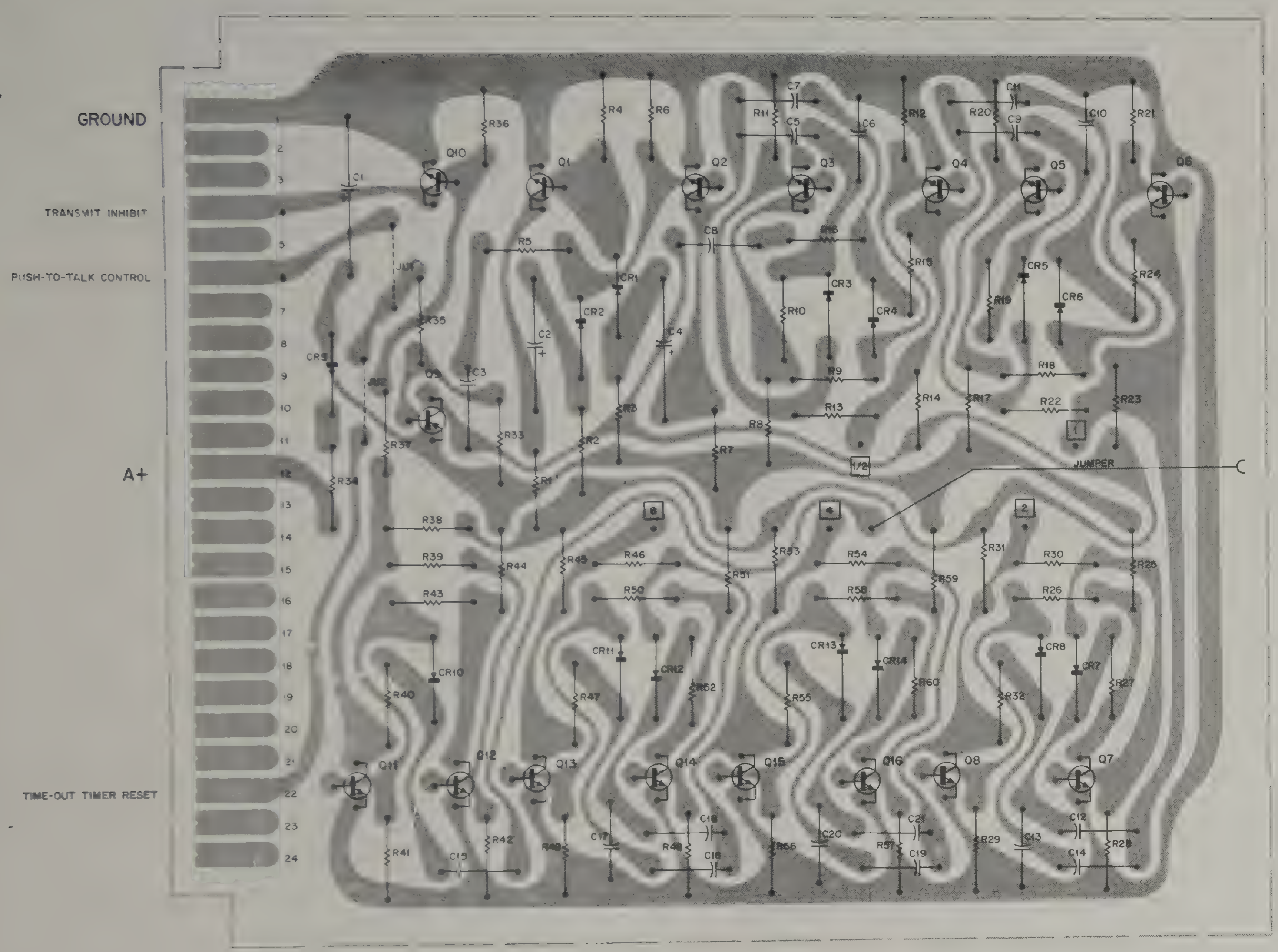
T-O-T TROUBLESHOOTING CHART

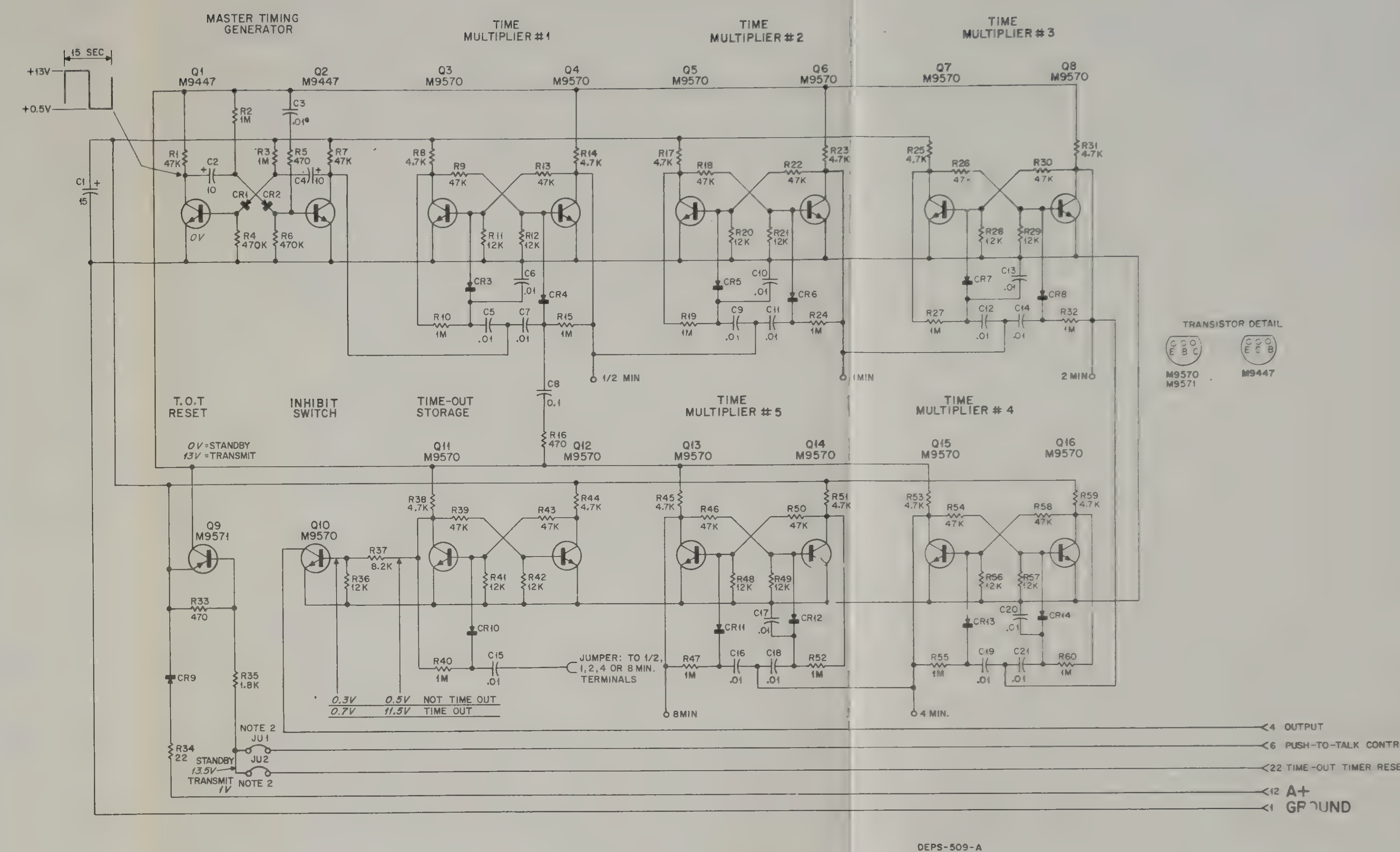


*C = CORRECT CYCLE OR VOLTAGES
I = INCORRECT CYCLE OR VOLTACES

CEPS-2020-O

TIME-OUT TIMER





MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX	DESCRIPTION
TLN1179A		TLN8769A		TIME-OUT TIMER BOARD
		TLN8770A		TIME-OUT TIMER PANEL

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K=1000)
   CAPACITOR VALUES ARE IN MICROFARADS.
2. JUMPER TABLE

APPLICATION	JU1*	JU2*
BASE STATION	IN	OUT
REPEATER (RT)	OUT	IN
BASE (RA) STATION	IN	OUT
REPEATER (RA) STATION	IN	OUT
COMMUNITY REPEATER	OUT	IN

*SEE SPECIAL JUMPER INFORMATION IN TEXT.

EPS-1027-A

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1179A Time-Out Timer Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81001E13-B
3/1/72-UP

SQUELCH GATE MODULE

MODEL TLN1180A

1. DESCRIPTION

The Squelch Gate Module is a plug-in unit for modular remote control units. It measures received noise levels and controls transmitter keying.

Using the inherent FM property of receiver quieting, it senses the presence of a received signal and converts it into a usable switched dc voltage for transmitter turn-on. When the noise level is high (no incoming receiver signal) the transmitter is turned off. When the noise level drops below the threshold value the squelch gate module provides an output that will key the transmitter ("Private-Line" tone-coded squelch stations also require a "PL" tone). The threshold level is adjustable to permit transmitter keying at approximately 10 to 25 dB receiver quieting.

NOTE

For most applications, the adjustment should be set for 20 dB quieting.

The F1 channel element switch used in the squelch gate module, in repeater (RT) stations without wire line control, controls the F1 transmitter oscillator. When the transmitter is keyed, the F1 channel element switch supplies a ground to the F1 channel element, enabling the oscillator.

During temporary rf signal fading conditions, the dropout delay generator is enabled which prevents transmitter turn-off during the preset time delay period (0, 1, 2, 4, or 8 seconds) until the rf signal is received again.

The push-to-talk switch supplies the necessary ground to enable the transmitter. It will remain on as long as a signal is being received or for the duration of the timed delay period.

The repeater level switch driven by the dropout delay generator, is used in repeater (RT) stations with wire line control to provide an output which activates the audio gate in the station logic module and places the REPEATER LEVEL control in the circuit. The REPEATER LEVEL control is used to adjust the audio from the receiver to a level equal with the audio from the line and is in the circuit only during repeater operation.

In repeater (RT) operation, the mute inhibit switch prevents the receiver from being muted

MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

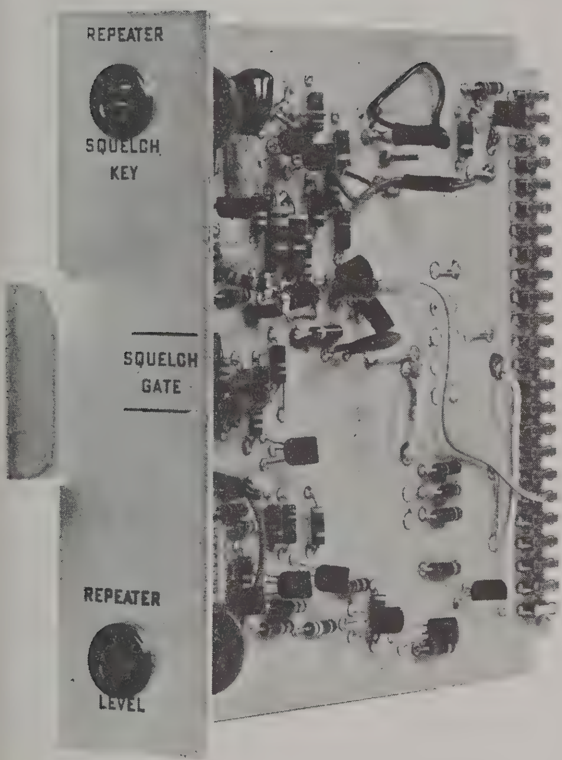
TLN8769A Time-Out Timer Board PL-284-O

		CAPACITOR, fixed:
C1	23K865136	15 uF ±20%; 25 v
C2, 4	23D82783B27	10 uF ±10%; 25 v
C3, 5, 6, 7, 9 thru 21	21D82428B35	.01 uF +80-20%; 500 v
C8	8D82905G07	0.1 uF ±10%; 50 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 14	48C82392B03	silicon
		TRANSISTOR: (SEE NOTE)
Q1, 2	48K869447	N-P-N; M9447
Q3 thru 8, 10 thru 16	48R869570	N-P-N; M9570
Q9	48R869571	P-N-P; M9571
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 7, 9, 13, 18, 22, 26, 30, 39, 43, 46, 50, 54, 58	6S128902	47K
R2, 3	6S129189	1 meg ±5%
R4, 6	6S129148	470K
R5, 16, 33	6S127801	470
R8, 14, 17, 23, 25, 31, 38, 44, 45, 51, 53, 59	6S127804	4.7K
R10, 15, 19, 24, 27, 32, 40, 47, 52, 55, 60	6S129013	1 meg
R11, 12, 20, 21, 28, 29, 36, 41, 42, 48, 49, 56, 57	6S129230	12K
R34	6S131641	22
R35	6S129269	1.8K
R37	6S128686	8.2K

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

SQUELCH GATE MODULE

MODEL TLN1180A



1. DESCRIPTION

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The repeater level switch driven by the dropout delay generator, is used in repeater (RT) stations with wire line control to provide an output which activates the audio gate in the station logic module and places the REPEATER LEVEL control in the circuit. The REPEATER LEVEL control is used to adjust the audio from the receiver to a level equal with the audio from the line and is in the circuit <u>only</u> during repeater operation.

In repeater (RT) operation, the mute inhibit switch prevents the receiver from being muted

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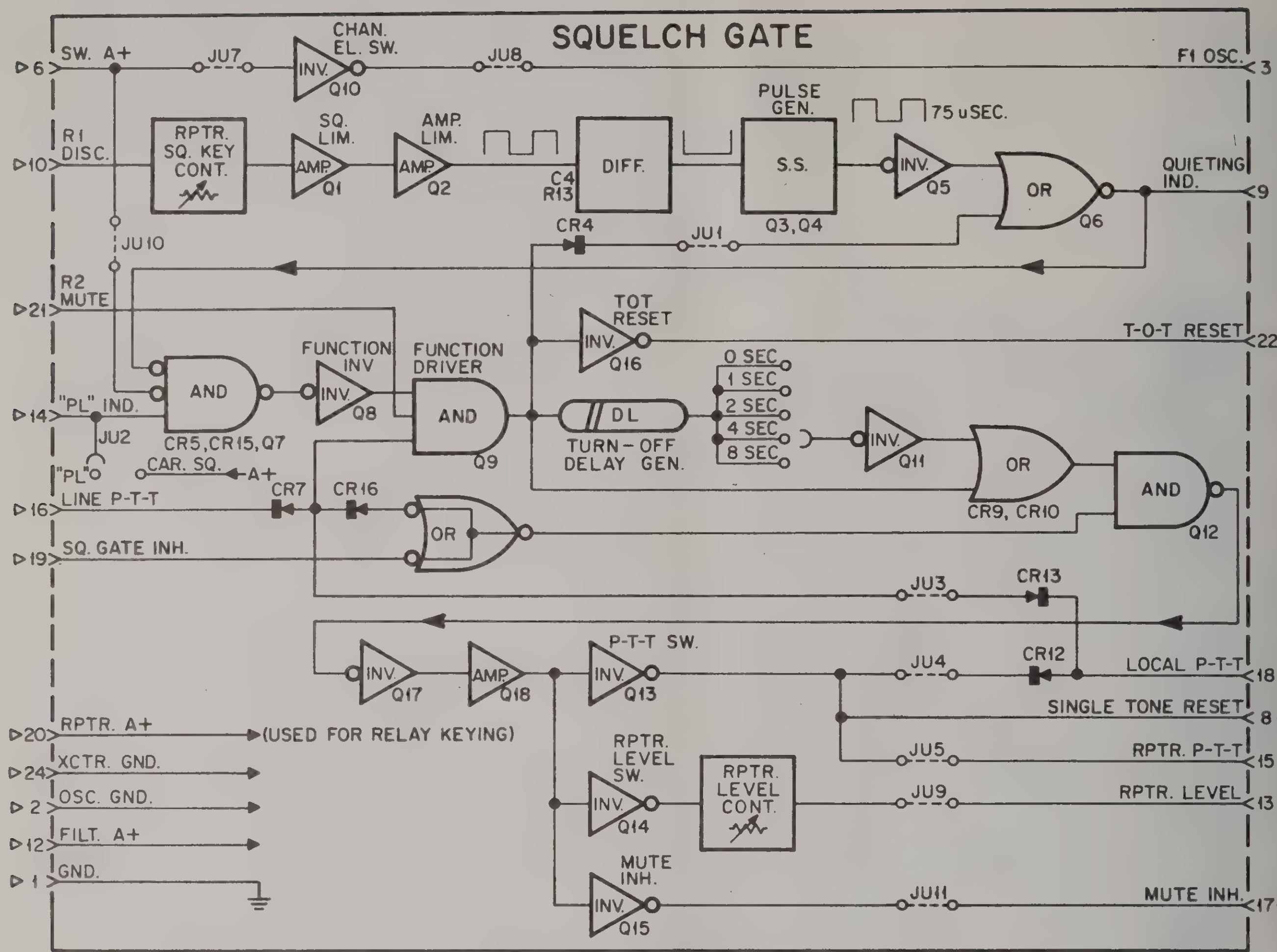


A LOW AT THE INPUT OF THE DELAY GENERATOR IS DELAYED AT THE OUTPUT OF Q11 BY THE TIME SELECTED BY THE TAPS.

CEPS-5841-0

during a received rf signal or during the timed delay period. However, this switch is not enabled in the local or wire line control modes and the receiver will be muted.

When a second transmission follows immediately after the end of the first transmission, the time-out timer reset switch is turned off, then on again immediately, to reset the time-out timer. However, as previously described, the transmitter will not necessarily turn off immediately because of the dropout delay generator. The time-out timer limits the maximum transmission time for any one message, but not the total continuous time that the transmitter may be keyed.

The line push-to-talk lead shorts the inverter output and the dropout delay generator to prevent the squelch gate module from operating during wire line keying.

The squelch gate inhibit lead and single-tone reset lead are used when an optional single-tone decoder module is used. An output from the single-tone decoder module is used in conjunction with the previously described operation of the squelch gate module to turn on the transmitter. Upon termination of transmission, the push-to-talk switch changes state to reset the single-tone decoder module. This reset occurs after the dropout time delay period has ended.

2. CIRCUIT DESCRIPTION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

a. Noise Detector

The R1 noise detector section in the squelch gate module includes the limiter, amplifier/switch, pulse generator, and inverter stages. The noise input from the discriminator of the receiver is adjusted to the desired threshold level by the REPEATER SQUELCH KEY potentiometer. The squelch limiter is driven between saturation and cutoff by noise spikes. When no rf input is applied to the receiver many noise spikes exceed the threshold level of the amplifier/switch, driving the transistor into saturation during such noise pulses. As the RF input to the receiver increases, fewer and fewer of the noise spikes exceed the threshold level. The coupling components between the amplifier switch and the pulse generator form a differentiation network for forming sharp triggers.

The pulse generator is a monostable multivibrator with Q3 cutoff and Q4 conducting in the quiescent condition. Each trigger applied to the pulse generator will produce a positive-going gate that is 75 microseconds in duration (output taken at the collector of Q4). With high noise the pulses will be very closely spaced, and with receiver quieting very few pulses will be generated.

The pulses are amplified and inverted by the inverter stage. An integrator network in the output of the inverter changes the pulses into a dc voltage that is proportional to the receiver quieting. With high noise input from the discriminator, the pulses are closely spaced and the integrated voltage resultant is a low dc voltage which turns on Q6. When the receiver quiets, the pulses are widely spaced and the integrated voltage resultant rises. When the quieting equals or exceeds the squelch gate threshold, the dc voltage resultant (or logic "high") is high enough to turn off Q6.

b. Switching Logic

(1) AND Gate Q7, CR5, & CR15 and OR Gate Q6

Q6 is an OR gate. It has two inputs; one from the inverter and the other through jumper JU1, which will be discussed later. The logic "high" from the output of the inverter will turn off Q6, causing its collector to go to a logic "low". The output of Q6 is applied to two places: (1) pin 9, which is a quieting indicator and will be used in the master decoder, in community repeaters, (2) to an AND gate consisting of Q7, CR5 and CR15. The output of Q6 is applied to the anode side of CR5. The anodes of CR5 and CR15 must be a logic "low" and the base of Q7 must be a logic "high" to obtain the desired logic "low" at the base of Q8.

The "PL" indicator is applied to the base of Q7. The "PL" indicator comes from the receiver's "PL" circuitry (if it is "PL" equipped), the master decoder in the community (RT) repeater, or will have an artificial input through the use of jumper JU2 (which is connected to A+) in carrier squelch stations. Switched A+ is applied to the other input of the AND gate through jumper JU10. This jumper is installed only in (RA) base stations and is used to give priority to transmissions originating from the control station.

In carrier squelch stations, receiver quieting is all that is required to key the transmitter. The "PL" input is simulated by connecting jumper JU2 to A+.

In "Private-Line" stations, jumper JU2 is open and a logic "high" is coupled to pin 14. This logic "high" causes Q7 to turn off; however, if the quieting indication (the output of OR gate Q6) is not a logic "low" CR5 will conduct, holding the output of the AND gate at the base of Q8 "high". When the output of OR gate Q6 goes "low", CR5 will cease to conduct and if no logic "high" is applied to the anode of CR15, or jumper JU10 is cut, the input to function inverter Q8 will be a logic "low". When Q8 turns off, its collector will go to a logic "high".

(2) Function Driver AND Gate Q9

The output of the function inverter is applied to the function driver AND gate, Q9. Q9 has three other inputs which are used to inhibit Q9. These inputs are line push-to-talk from pin 16, R2 mute from pin 21, and local push-to-talk through jumper JU3. The line push-to-talk input is used to inhibit the squelch gate on wire line controlled (RT) repeaters. This input is discussed in greater detail later. The R2 mute input on pin 21 is used as an inhibit signal for repeater knockdown in line controlled (RT) repeaters. The local push-to-talk input is used in repeater (RA) base stations. When jumper JU3 is installed, JU4 is out and the local push-to-talk is generated in the (RA) base station. This gives the control station priority over the repeater, or in other words, if a transmission is commanded from the control station, even though a signal is in the process of being relayed to the control station, the outgoing transmission will have priority.

The output from the function driver AND gate Q9 is applied thru CR4 to jumper JU1, to the dropout delay generator, to one input to the OR gate (anode of CR9) and to the time-out timer reset switch simultaneously.

(3) Jumper JU1

Jumper JU1 at the base of Q6 is used in "Private-Line" tone-coded squelch stations and removed in carrier squelch station. During temporary fading conditions in which receiver quieting is lost, the squelch gate module will remain enabled if a "PL" tone is present and jumper JU1 is connected. If the "PL" tone is also lost, the squelch gate module will become inhibited and the transmitter will turn off. It is important to note in carrier squelch stations jumper JU1 must be removed from the circuit or the output from the inverter will always be a logic "high" which continuously enables the squelch gate module. Jumper JU2 provides one of the necessary inputs to the AND gate transistor Q7 to enable the squelch gate module. JU2 is connected to A+ in all carrier squelch stations. Place JU2 in the "PL" position for use in "Private-Line" applications.

(4) Dropout Delay Generator and OR Gate CR9, CR10

Q11 in the dropout delay generator is normally conducting and is off only during the dropout delay. A+ is continually applied thru the input string of series delay resistors R35 thru R39 to the bottom side of C9 and thru CR8 to the base of Q11. Q11 is forward biased. Its collector is a logic "low" and is applied to one input of the OR gate (anode of CR10). C9 is charged at this time because one side is connected to A+ thru the delay resistors (R35 thru R39) and the other side is connected to a logic "low" from Q9.

When the output of Q9 switches to a logic "high" (the beginning of repeater transmission), the logic "high" is coupled into the OR gate anode of CR9, enabling the push-to-talk switch circuitry (Q12, Q17, Q18 and Q13) which turns on the transmitter. At the same time, the logic "high" is applied to capacitor C9, discharging it almost immediately through resistor R40, transistor Q11, (emitter to base), and diode CR8. Q11 is forward biased from A+ on its base and is conducting while capacitor C9 is discharging. The time delay before transmitter turn-off is initiated when the logic "high" is removed from capacitor C9. The logic "high" is also removed from diode CR9, removing one input of the OR gate. Capacitor C9 cannot charge thru diode CR8 (as in discharging C9), but instead must charge through the chosen resistor, or resistors, R35 thru R39. This capacitor-resistor combination is a series RC time delay circuit that, with different values of resistance, makes it possible to vary the charge time of capacitor C9. While C9 is charging, the voltage on the base of Q11 is lower than required to make it conduct. With Q11 off, full A+ or a logic "high" is felt on CR10, the input to the OR gate and remains there until Q11 starts conducting again after C9 becomes charged.

A logic "high" arriving at the OR gate from either the dropout delay generator or diode CR9 is directly routed to the switch drive transistors, causing the transmitter to be keyed.

(5) Time-Out Timer Reset

The time-out timer reset transistor switch conducts whenever a logic "high" forward biases it. This conduction mode presents an effective ground potential, through the transistor, to the time-out timer which initiates the timed period in repeater (RT) operation. It should be noted that in wire-line controlled (RT) repeaters, the time-out timer is not operated during line transmissions.

(6) Switch Drivers and Output Switches

The switch driver transistors provide the necessary current drive to the push-to-talk switch, mute inhibit switch and repeater level switch on the squelch gate module. Fading signal conditions will not affect these switches during the dropout delay period because they are controlled from the drop-out delay generator. The push-to-talk, mute inhibit, and repeater level switch are enabled when the emitter of Q18 goes to a logic "high". All three switches turn on and the collectors of the push-to-talk switch, Q13, and the mute inhibit switch, Q15, go to a logic "low". The collector of Q14 also goes to a logic "low" and provides an effective ground at one end of the REPEATER LEVEL control R49. R49 adjusts the forward bias on a diode in the station logic module which adjusts the repeated audio exciter level. This output is used in wire-line controlled repeaters only. Jumper JU9 is cut in all other applications. The output from the mute inhibit switch disables the receiver muting circuitry in the station logic module during a repeat function.

Jumper JU4 is used in repeater (RT) and community repeater (RT) stations to provide the continuity path for the local push-to-talk switch output.

(7) F1 Channel Element Switch

The F1 channel element switch on the squelch gate module is used on all stations except wire-line controlled repeater (RT) stations. In

this case, jumpers JU7 and JU8 must be removed because the F1 channel element switch on the DC transfer module (or the F1 control module in tone systems) is used. When the transmitter is keyed, switched A+ from the station logic module is applied to pin 6 and coupled through jumper JU7 to the base of Q10. The F1 channel element switch Q10 turns on, providing an effective ground at the collector through jumper JU8 to the F1 channel element in the transmitter.

(8) Single-Tone Control

The squelch gate inhibit lead is used in conjunction with a single-tone decoder module. Normally, this lead is at ground potential and the squelch gate module is inhibited. When a single-tone signal arrives at the single-tone module, the squelch gate inhibit lead is removed from ground potential. This removes the ground potential from the input of the switch drivers, and, with a logic "high" from the function driver, enables the squelch gate module which, in turn, keys the transmitter. When the collector of the push-to-talk switch goes from a logic "low" to a "high", the single-tone decoder module is reset via the single-tone reset lead.

c. Wire Line Priority

As mentioned before, line push-to-talk is applied to pin 16 to inhibit the squelch gate during line transmissions. The line push-to-talk logic "low" is applied to two places in the squelch gate module: (1) the base of Q9, the function driver. This inhibits Q9 and prevents the time-out timer reset switch from operating during a line push-to-talk. (2) through the diode OR gate CR16 to the base of Q12, the first of the push-to-talk switch drivers. The purpose of this second application is to turn off the squelch gate push-to-talk circuitry immediately (no dropout delay) so that the repeater level switch and mute inhibit switch are disabled during line transmission.

d. Base (RA) and Repeater (RA) Applications

Jumper JU10 is installed in carrier squelch and "Private-Line" tone-coded squelch base (RA) stations to prevent the keying of repeater (RA) companion stations during the reverse burst period. In (RA) base stations, jumpers JU3 and JU10 are installed and JU4 is cut. Local P-T-T is an input in this application as an inhibit signal coupled thru JU3 to the function driver AND gate. When the (RA) repeater station keys the (RA) base station, (an outgoing transmission), the squelch gate module is prevented from keying the (RA) repeater transmitter.

At the end of an outgoing transmission, the (RA) repeater station will no longer provide a ground to the local P-T-T lead in the base (RA) station. This action results in the loss of the inhibit signal thru JU3 to the base of Q9, the function driver AND gate. In (RA) base stations equipped with "Private-Line" operation, the "PL" encoder will keep the (RA) base station keyed for approximately 150 milliseconds after the loss of P-T-T. During the reverse burst, switched A+ is maintained from the station logic module in the (RA) base station. This switched A+ is applied thru jumper JU10 to an input of an AND gate (CR15 anode) and maintains the inhibit to the base (RA) station squelch gate for the duration of the reverse burst.

In (RA) repeater stations jumpers JU3, JU4, and JU10 are cut. The inhibit signals just discussed are not used in (RA) repeater application to give the outgoing transmission priority.

(1) Solid State Companion Station

Jumper JU5 and JU6 are installed in repeater (RA) and base (RA) stations to complete the transmitter push-to-talk circuits in an associated (RA) station containing a solid state remote control chassis.

When the squelch gate module in either the (RA) repeater or the (RA) base station commands a transmission, a P-T-T "low" is coupled from the P-T-T switch Q13, out of the squelch gate module thru jumper JU5, to the repeater P-T-T, pin 15. Diode CR11 is removed in this application.

(2) Relay Keyed Companion Station

If the companion station is an older type using relay keying, the optional TLN4151A Relay Kit is used. Some of these stations require voltages greater than 100 volts and, therefore, it is not practical to use the solid state switching in the squelch gate module. When the relay kit is installed, jumpers JU5 and JU6 are cut and CR11 is installed as a transient suppressor. An external Repeater A+ is connected to pin 20 of the squelch gate module. When the squelch gate module commands a transmission, the P-T-T switch, Q13, completes the circuit to the relay, K1. When the relay energizes, it completes the circuit to provide switched A+ to the Repeater P-T-T lead (pin 15), which keys the companion station.

3. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To initially determine the location of the fault, operate the station by local means, and initiate the desired function from the module. If the desired function is performed, then the module is functioning properly. If the function does not perform, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the circuitry, remove the module, insert a Model TLN8799A Servicing Board Kit and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

Servicing may be done without connection to a remote control chassis if the proper power and terminations are connected to the module. A convenient method of connection is through the use of a TEK-38 Base Station Module Servicing Adapter. The module is simply plugged into the 24-pin male plug of the adapter. Connections are then made to the circuit module via the adapter using the standard and/or resistor push on patch leads supplied with the adapter.

Use reasonable care in handling and servicing the module.

Remove the squelch gate module from the remote control unit by pulling it straight out. Check jumpers for correct application in the specific mode of operation.

NOTE

It will be advantageous to keep notes showing correct jumper hookups to facilitate reassembly after testing and repair is completed.

The jumpers and controls in the module must be set as follows during testing:

JU1 - OUT
JU2 - IN
JU3 - OUT
JU4 - IN
JU5 - (NOT APPLICABLE)
JU6 - (NOT APPLICABLE)
JU7 - IN
JU8 - IN
JU9 - IN
JU10 - OUT
DROPOUT DELAY LEAD - 8 SECONDS
REPEATER SQUELCH KEY - MAXIMUM (CLOCKWISE)
REPEATER LEVEL - MAXIMUM (COUNTERCLOCKWISE)

Set up a test condition as shown in the attached test set up diagram. Pin clip connectors are an efficient method of connecting the module pins to the test set up. Refer to the squelch gate module schematic diagram while testing the module and referencing pin numbers to corresponding stages. Any specific test result that does not correspond with the stated value in the following procedure can be related from the identifying pin number to the defective stage. Check the squelch limiter to function driver stages when many or all test output indications are incorrect.

Apply a 1-volt 10 kHz audio signal to pin 10 on the module. This simulates receiver noise from the discriminator during no received rf signal conditions. Within approximately 8 seconds, pins 13, 17, 18, and 22 should be at +12 v dc. Pin 3 should be (and remain at) ground potential.

Remove the audio oscillator from pin 10. This should cause pins 13, 17, 18, and 22 to go to ground potential immediately.

Reapply the audio signal to pin 10 on the module. Pin 22 should immediately go to +12 v dc. Pins 13, 17, and 18 should go to +12 v dc after the time delay of 8 seconds.

Remove the audio oscillator from pin 10 and connect the dropout delay lead to the specific delay interval pin required. Reconnect the audio oscillator and repeat the test procedure as previously done for the 8-second delay. This completes the test procedure and should have isolated the malfunction. Correct as necessary.

Replace all jumper connections as they should be for the specific mode of operation and install the module in the remote control unit. Reset the repeater squelch key and repeater level controls as described in the Installation and Operation Section of this manual.

c. <u>Carrier Squelch Operation of "Private-Line" Station</u>

While servicing "Private-Line" stations, jumpers JU1 and JU2 on the squelch gate module can be connected for carrier squelch operation, but the receiver remains continuously unsquelched. The receiver will squelch and unsquelch normally by removing the GRN-BRN lead (repeater control or PL indicator function) from the "Private-Line" decoder circuit board to the audio and squelch circuit board of the receiver. After the lead is removed, the receiver may be PL disabled with the "PL" DISABLE switch on the local control panel or by grounding the PL disable terminal in the junction box.

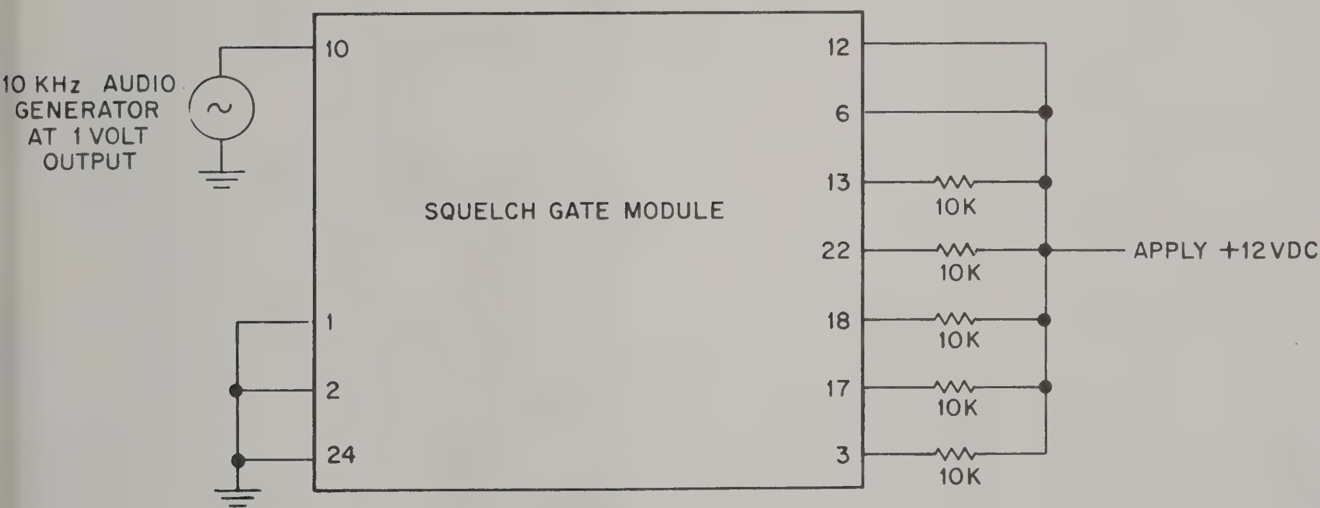
NOTE

In the 25-50 MHz repeater stations, an alternate security method (such as single-tone decoder) must be used if the station is operated with the "Private-Line" security disabled.

d. <u>Prevention of Momentary Keying</u>

In some instances momentary keying of a companion (RA) repeater at the end of a transmission, or a momentary switched output from the squelch gate module used in other base station applications, may occur. To prevent this, remove the cathode side of CR15 from the base of Q8 and connect it to the base of Q5 (when JU10 is in).

In this configuration, switched A+ turns inverter Q5 on through CR15 when the transmitter is keyed. This keeps the integrator capacitors (C6 and C7) from charging and activating the AND gate when switched A+ is removed. Jumpers JU10 and JU3 disable the squelch gate P-T-T switch (Q13) during the transmit mode.



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Test Set Up Diagram

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN8771A Squelch Gate Circuit Board PL-462-O

		CAPACITOR, fixed:
C1, 10	8C82905G01	.01 uF ±10%; 50 v
C2	21K859943	250 pF ±5%; 500 v
C3	8C82905G02	.022 uF ±10%; 50 v
C4	21K850510	470 pF ±10%; 300 v
C5	21K850994	3000 pF ±5%; 500 v
C6, 7	23K865137	4.7 uF ±20%; 25 v
C8	21D82187B29	.001 uF ±10%; 100 v
C9	23K865594	68 uF ±10%; 15 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 16	48C82392B03	silicon; RD1343
		TRANSISTOR: (SEE NOTE)
Q1	48R869594	N-P-N; M9594
Q2, 3, 4, 5, 8, 9, 11, 12, 14, 16, 18	48R869570	N-P-N; M9570
Q6, 7, 17	48R869571	P-N-P; M9571
Q10	48R869567	N-P-N; M9567
Q13, 15	48R869568	N-P-N; M9568
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 34	6S129231	3.3K
R2	18C83083G03	variable; 25K
R4	6S131594	27
R5	6S127806	27K
R6	6S129146	150K
R7	6S124A13	33 ±5%
R8	6S129805	1K ±5%
R9, 32, 47	6S127804	4.7K
R10, 41, 44, 61	6S128902	47K
R11	6S128689	2.2K
R12	6S128687	6.8K
R13	6S127807	33K
R14, 33, 50, 62	6S127803	1.5K
R15	6S129526	33K ±5%
R16, 17, 18, 21, 24, 59, 60	6S128685	22K
R19	6S128688	2.7K
R20, 25, 26, 35, 42, 43, 46, 51	6S129225	10K
R22, 23	6S129231	3.3K
R27	6S120638	330 ±5%; 1/2 w
R28, 39	6S129145	82K
R29, 36, 56	6S128686	8.2K
R30	6S400812	470 ±5%; 1/2 w
R31	6S129230	12K
R37, 52	6S128904	18K
R38	6S128903	39K
R40	6S129775	330
R48, 57	6S127802	1K
R49	18C83083G04	variable; 1K
R53, 58	6S129232	3.9K
R55	6S124A05	15 ±5%

TLN4151A Relay Kit PL-455-O

		RELAY, armature:
K1	80C84201A01	2 form "C", coil res. 200 ohms

TLN8772A Squelch Gate Panel PL-454-O

	64B83926G01	PANEL, squelch gate
	45B83914G01	GUIDE, printed circuit board: 2 req'd
	43B82721C01	INSULATOR, bushing: 2 req'd
	46B83284H01	PLUG, keying

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

CAUTION
.EMOVE DIODE CR11 IN RA STATIONS
/HEN RELAY K1 IS NOT USED.

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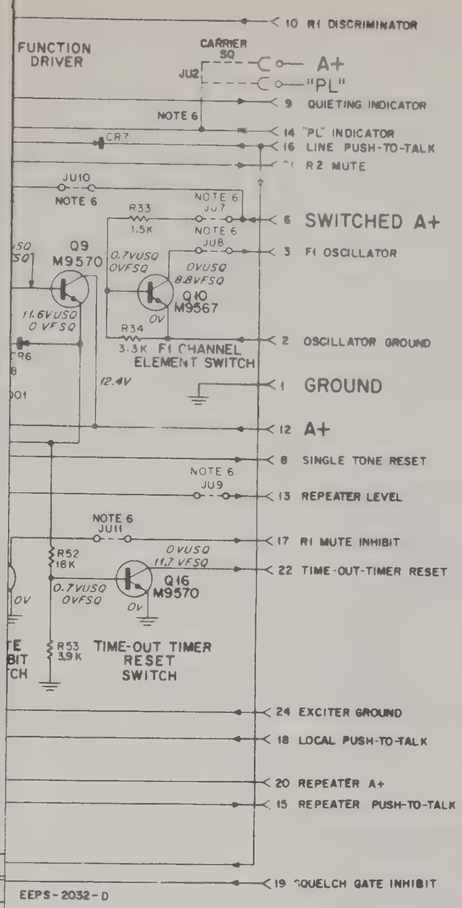

MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX
TLN1180A		TLN8771A	
		TLN8772A	

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K = 1000)
   CAPACITOR VALUES ARE IN MICROFARADS
2. JUMPER CONNECTS TO TERMINAL $\boxed{0}$, $\boxed{1}$, $\boxed{2}$, $\boxed{4}$ OR $\boxed{8}$
   DROPOUT DELAY TIME (IN SECONDS).
3. VOLTAGE READINGS SHOWN FOR TWO CONDITIONS
   USQ = UNSQUELCHED
   FSQ = FULLY SQUELCHED
4. RELAY KIT IS AN OPTIONAL ACCESSORY ITEM. REFER T
   CR11, JU5 AND JU6 USAGE WITH RELAY.
5. USE OF THIS RESISTOR IS DETERMINED AT FACTORY.
6. REFER TO JUMPER TABLE.
7. REFER TO "PREVENTION OF MOMENTARY KEYING" PAR
   OPTIONAL CR15 CONNECTION.

DETAIL

JUMPER TABLE

APPLICATION	JU1	JU2	JU3	JU4	JU
CARRIER SQUELCH REPEATER (RT) STATION WITHOUT WIRE LINE CONTROL	CARR. SQ.	CARR. SQ.	OUT	IN	IN
"PRIVATE-LINE" TONE-CODED SQUELCH REPEATER (RT) STATION WITHOUT WIRE LINE CONTROL	"PL"	"PL"	OUT	IN	IN
CARRIER SQUELCH REPEATER (RT) STATION WITH WIRE LINE CONTROL	CARR. SQ.	CARR. SQ.	OUT	IN	IN
"PRIVATE-LINE" TONE-CODED SQUELCH REPEATER (RT) STATION WITH WIRE LINE CONTROL	"PL"	"PL"	OUT	IN	IN
CARRIER SQUELCH BASE OR BASE (RA) STATION	CARR. SQ.	CARR. SQ.	IN	OUT	*
"PRIVATE-LINE" TONE-CODED SQUELCH BASE OR BASE (RA) STATION	"PL"	"PL"	IN	OUT	*
CARRIER SQUELCH REPEATER (RA) STATION	CARR. SQ.	CARR. SQ.	OUT	OUT	*
"PRIVATE-LINE" TONE-CODED SQUELCH REPEATER (RA) STATION	"PL"	"PL"	OUT	OUT	*
COMMUNITY REPEATER (RT) STATION	PL"	"PL"	OUT	IN	IN

*RELAY APPLICATION CHA

TLN4151A RELAY KIT	DIODE CR11	JU5
NOT USED	OUT	IN
USED	IN	OUT

LIST SHOWN ON
F THIS DIAGRAM

0A Squelch Gate Module
ic Diagram & Circuit Board Detail
a No. 63P81005E62-D
UP

SQUELCH GATE MODULE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN8771A Squelch Gate Circuit Board PL-462-O

		CAPACITOR, fixed:
C1, 10	8C82905G01	.01 uF ±10%; 50 v
C2	21K859943	250 pF ±5%; 500 v
C3	8C82905G02	.022 uF ±10%; 50 v
C4	21K850510	470 pF ±10%; 300 v
C5	21K850994	3000 pF ±5%; 500 v
C6, 7	23K865137	4.7 uF ±20%; 25 v
C8	21D82187B29	.001 uF ±10%; 100 v
C9	23K865594	68 uF ±10%; 15 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 16	48C82392B03	silicon; RD1343
		TRANSISTOR: (SEE NOTE)
Q1	48R869594	N-P-N; M9594
Q2, 3, 4, 5, 8, 9, 11, 12, 14, 16, 18	48R869570	N-P-N; M9570
Q6, 7, 17	48R869571	P-N-P; M9571
Q10	48R869567	N-P-N; M9567
Q13, 15	48R869568	N-P-N; M9568
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 34	6S129231	3.3K
R2	18C83083G03	variable; 25K
R4	6S131594	27
R5	6S127806	27K
R6	6S129146	150K
R7	6S124A13	33 ±5%
R8	6S129805	1K ±5%
R9, 32, 47	6S127804	4.7K
R10, 41, 44, 61	6S128902	47K
R11	6S128689	2.2K
R12	6S128687	6.8K
R13	6S127807	33K
R14, 33, 50, 62	6S127803	1.5K
R15	6S129526	33K ±5%
R16, 17, 18, 21, 24, 59, 60	6S128685	22K
R19	6S128688	2.7K
R20, 25, 26, 35, 42, 43, 46, 51	6S129225	10K
R22, 23	6S129231	3.3K
R27	6S120638	330 ±5%; 1/2 w
R28, 39	6S129145	82K
R29, 36, 56	6S128686	8.2K
R30	6S400812	470 ±5%; 1/2 w
R31	6S129230	12K
R37, 52	6S128904	18K
R38	6S128903	39K
R40	6S129775	330
R48, 57	6S127802	1K
R49	18C83083G04	variable; 1K
R53, 58	6S129232	3.9K
R55	6S124A05	15 ±5%

TLN4151A Relay Kit PL-455-O

		RELAY, armature:
K1	80C84201A01	2 form "C", coil res. 200 ohms

TLN8772A Squelch Gate Panel PL-454-O

	64B83926G01	PANEL, squelch gate
	45B83914G01	GUIDE, printed circuit board: 2 req'd
	43B82721C01	INSULATOR, bushing: 2 req'd
	46B83284H01	PLUG, keying

NOTE:
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

CAUTION
REMOVE DIODE CR11 IN RA STATIONS WHEN RELAY K1 IS NOT USED.

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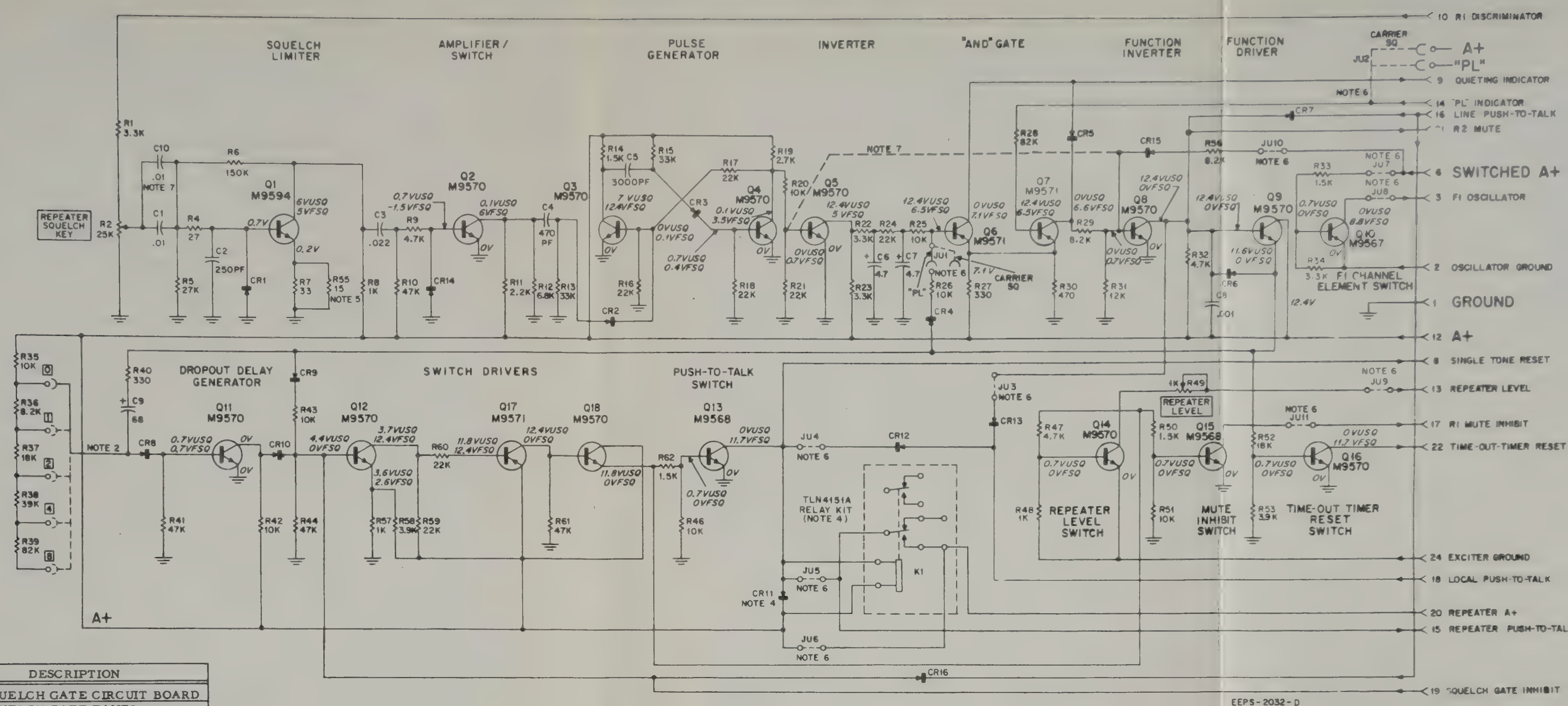

MODEL TABLE

MODEL	SUFFIX	KIT	SUFFIX	DESCRIPTION
TLN1180A		TLN8771A		SQUELCH GATE CIRCUIT BOARD
		TLN8772A		SQUELCH GATE PANEL

NOTES:

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS (K = 1000)
   CAPACITOR VALUES ARE IN MICROFARADS
2. JUMPER CONNECTS TO TERMINAL 0, 1, 2, 4 OR 8 TO SET THE DROPOUT DELAY TIME (IN SECONDS)
3. VOLTAGE READINGS SHOWN FOR TWO CONDITIONS
   USQ = UNSQUELCHED
   FSQ = FULLY SQUELCHED
4. RELAY KIT IS AN OPTIONAL ACCESSORY ITEM. REFER TO RELAY APPLICATION CHART FOR CR11, JU5 AND JU6 USAGE WITH RELAY.
5. USE OF THIS RESISTOR IS DETERMINED AT FACTORY.
6. REFER TO JUMPER TABLE.
7. REFER TO "PREVENTION OF MOMENTARY KEYING" PARAGRAPH IN INSTRUCTIONS, FOR OPTIONAL CR15 CONNECTION.

TRANSISTOR DETAIL

JUMPER TABLE

APPLICATION	JU1	JU2	JU3	JU4	JU5	JU6	JU7	JU8	JU9	JU10	JU11
CARRIER SQUELCH REPEATER (RT) STATION WITHOUT WIRE LINE CONTROL	CARR. SQ.	CARR. SQ.	OUT	IN	IN	IN	IN	IN	OUT	OUT	IN
"PRIVATE-LINE" TONE-CODED SQUELCH REPEATER (RT) STATION WITHOUT WIRE LINE CONTROL	"PL"	"PL"	OUT	IN	IN	IN	IN	IN	OUT	OUT	IN
CARRIER SQUELCH REPEATER (RT) STATION WITH WIRE LINE CONTROL	CARR. SQ.	CARR. SQ.	OUT	IN	IN	IN	OUT	OUT	IN	OUT	IN
"PRIVATE-LINE" TONE-CODED SQUELCH REPEATER (RT) STATION WITH WIRE LINE CONTROL	"PL"	"PL"	OUT	IN	IN	IN	OUT	OUT	IN	OUT	IN
CARRIER SQUELCH BASE OR BASE (RA) STATION	CARR. SQ.	CARR. SQ.	IN	OUT	*	*	IN	IN	OUT	IN	OUT
"PRIVATE-LINE" TONE-CODED SQUELCH BASE OR BASE (RA) STATION	"PL"	"PL"	IN	OUT	*	*	IN	IN	OUT	IN	OUT
CARRIER SQUELCH REPEATER (RA) STATION	CARR. SQ.	CARR. SQ.	OUT	OUT	*	*	IN	IN	OUT	OUT	IN
"PRIVATE-LINE" TONE-CODED SQUELCH REPEATER (RA) STATION	'PL"	"PL"	OUT	OUT	*	*	IN	IN	OUT	OUT	IN
COMMUNITY REPEATER (RT) STATION	PL"	"PL"	OUT	IN	IN	IN	IN	IN	OUT	OUT	IN

*RELAY APPLICATION CHART

TLN4151A RELAY KIT	DIODE CR11	JU5	JU6
NOT USED	OUT	IN	IN
USED	IN	OUT	OUT

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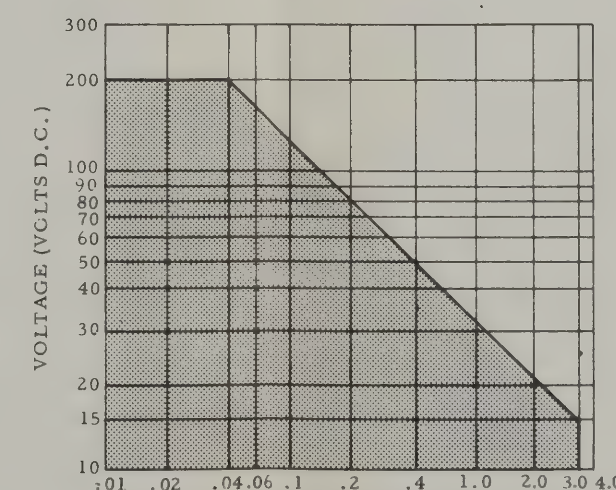


LOAD MUST BE IN SHADED AREA

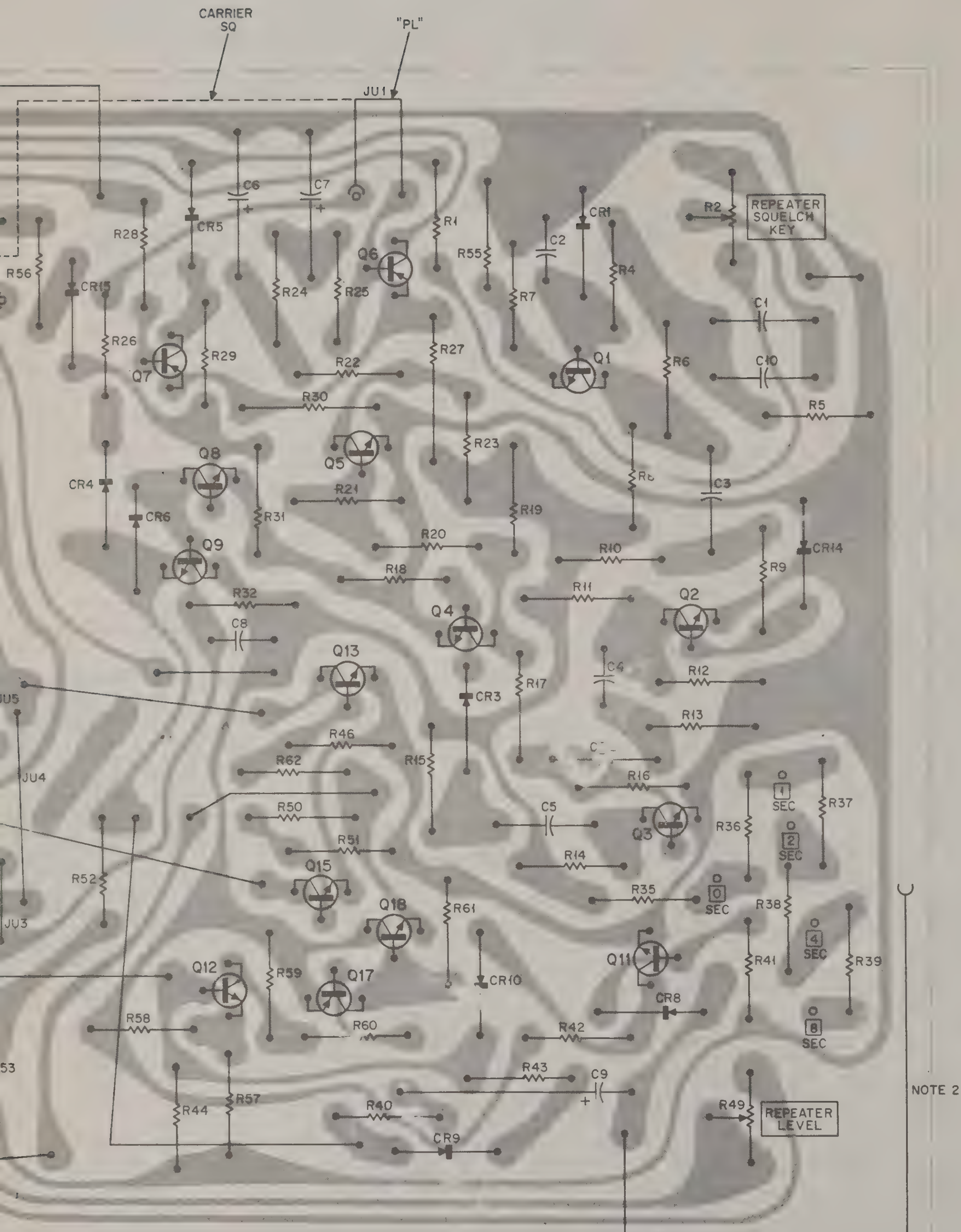
AEPS-1527-O

TLN4151A Relay Kit
Relay Contact Ratings

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1180A Squelch Gate Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81005E62-D
3/1/72-UP

SQUELCH GATE MODULE



BD DEPS-2029-D
OL-DEPS-2030-B

SINGLE-TONE DECODER MODULE

MODEL TLN1181A

1. DESCRIPTION

The single-tone decoder module is an optional accessory item for Motorola FM two-way radio stations. It is a fully transistorized module that plugs into the dc remote control chassis. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed. Two test switches on the front panel permit manual operation for testing and maintenance.

The single-tone decoder module adapts stations for use in single-tone signalling systems. Such a system may use single-tone frequencies to select a specific repeater from a multiple repeater network. In such a system, each repeater is equipped with a single-tone decoder of a different frequency. The repeaters are disabled until the proper tone frequency is received. The proper tone is decoded by the module and its output used to enable the repeater.

Other typical applications for the module are remote monitoring and control of external signalling devices.

2. FUNCTIONS

A specific audio tone input in the 600 to 3300 Hz range actuates the module, providing a switched ground or switched voltage output (as desired) to control external circuits. Decoders are available in 19 different frequencies from 600 to 3300 Hz spaced at 150 Hz. Each module has its specific frequency of operation stamped on the chassis. The proper tone applied to the module for approximately 300 continuous milliseconds initiates operation.

Jumpers can be connected to place the module in either of two basic modes of operation; "lock" or "non-lock". In the "lock" mode, the correct tone input actuates the decoder. The decoder "locks" in this state until reset by an external signal. In the "non-lock" mode, the correct tone input actuates the decoder and it resets when the tone input is removed. The "non-lock" mode can have a 5-second turn-off delay by connecting another jumper.

An optional relay may be added to the circuit board, if desired, for special applications. The relay is energized in a "lock" or "non-lock" mode when the correct tone input actuates the decoder.

3. CIRCUIT OPERATION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

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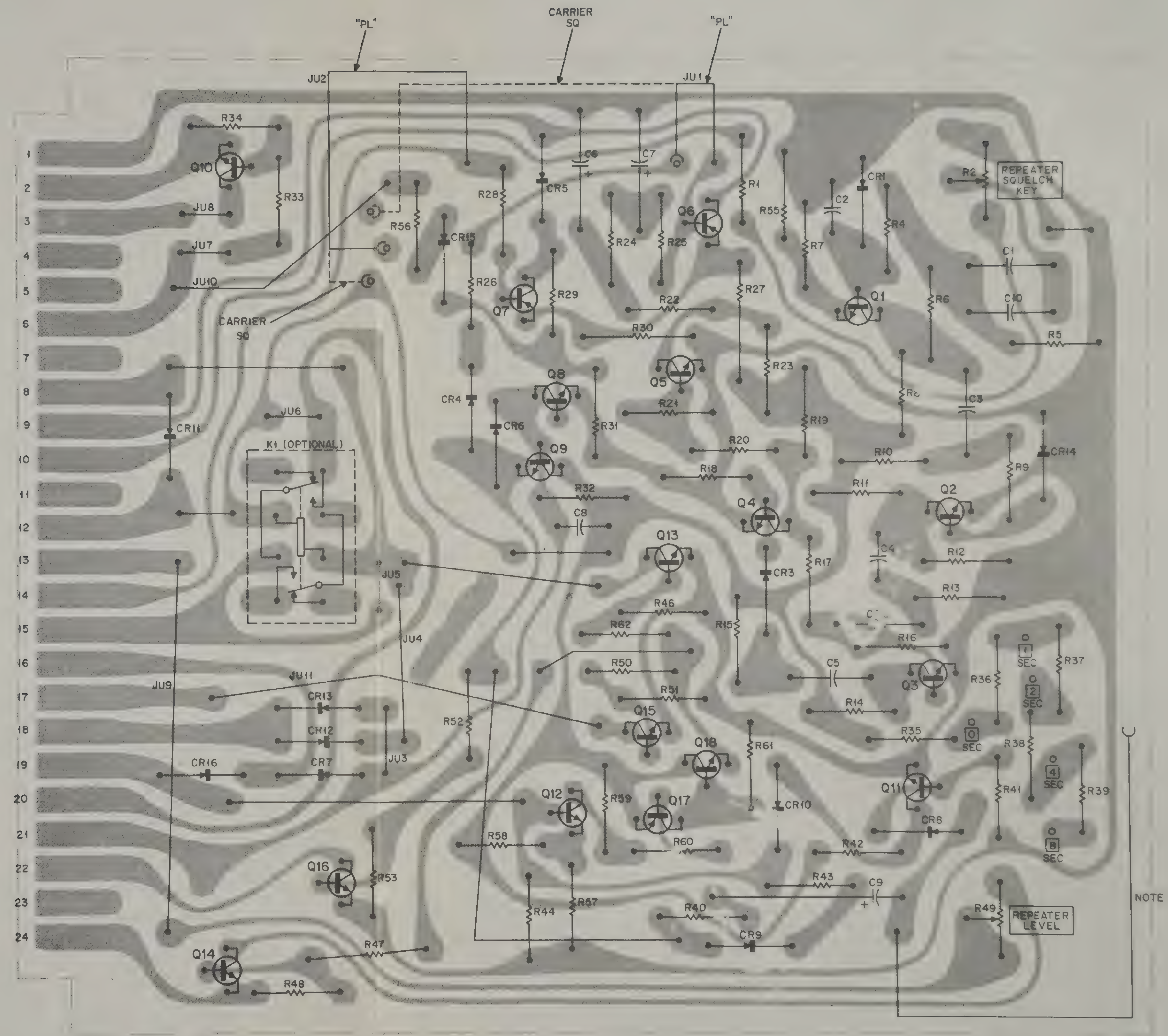

OL-DEPS-2030-B

SINGLE-TONE DECODER MODULE

MODEL TLN1181A

1. DESCRIPTION

The single-tone decoder module is an optional accessory item for Motorola FM two-way radio stations. It is a fully transistorized module that plugs into the dc remote control chassis. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed. Two test switches on the front panel permit manual operation for testing and maintenance.

The single-tone decoder module adapts stations for use in single-tone signalling systems. Such a system may use single-tone frequencies to select a specific repeater from a multiple repeater network. In such a system, each repeater is equipped with a single-tone decoder of a different frequency. The repeaters are disabled until the proper tone frequency is received. The proper tone is decoded by the module and its output used to enable the repeater.

Other typical applications for the module are remote monitoring and control of external signalling devices.

2. FUNCTIONS

A specific audio tone input in the 600 to 3300 Hz range actuates the module, providing a switched ground or switched voltage output (as desired) to control external circuits. Decoders are available in 19 different frequencies from 600 to 3300 Hz spaced at 150 Hz. Each module has its specific frequency of operation stamped on the chassis. The proper tone applied to the module for approximately 300 continuous milliseconds initiates operation.

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An optional relay may be added to the circuit board, if desired, for special applications. The relay is energized in a "lock" or "non-lock" mode when the correct tone input actuates the decoder.

3. CIRCUIT OPERATION

NOTE

For a description of the basic circuits used in the logic circuitry, refer to the remote control chassis section.

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The tone input from the receiver discriminator is amplified by Q751. Frequencies above 3300 Hz are attenuated by coupling components. The amplified signal is converted into a square wave by clipper transistor Q752. Q753 is a buffer stage which isolates the clipper stage from the following LC tank circuit. The tank circuit determines the single-tone frequency at which the module will operate and converts the square wave signal back into a sine wave to drive Q754. This detector stage produces a positive-going sawtooth signal that is applied to integrator network (R767 and C758). A signal applied for approximately 300 continuous milliseconds on C758 charges the capacitor sufficiently to cause switching transistor Q755 to conduct. Diode CR753, resistor R766, and capacitor C757 help prevent unintentional operation from random voice signals of the proper frequency by discharging C758 almost immediately upon loss of the sawtooth signal.

Switching transistors Q755 and Q756 conduct or turn "on" during the presence of tone and are "off" during no-tone conditions. Switch stage Q757 is also "on" during the presence of tone. When tone is removed, capacitor C760 and resistor R774 will provide a 5-second delay in turn-off if jumper JU1 is connected ("non-lock" delay mode). Greater time delay is possible by replacing R774 with a larger resistor. The output of Q757 is the triggering voltage for Schmitt trigger Q758 and Q759.

Schmitt trigger (Q758 and Q759) provides a low level output while a tone is being received. During no-tone conditions the output returns to a higher level, when the decoder is operated in the "non-lock" mode. The "lock" mode is selected by connecting jumper JU2. In this mode, the Schmitt trigger "locks" in the "on" condition until a reset "high" is applied at pin 9 (or the RESET switch is operated).

The A+ switch (Q760) provides a switched A+ output when the proper tone is decoded. Inverter Q761 provides a switched ground output when the proper tone is decoded. Either output can be used depending upon the application. When jumper JU3 is removed and jumper JU4 is connected, an external ground input may be supplied to Q761. It will then operate as an AND gate, requiring both the external ground and the proper tone to give a switched ground output.

When the relay is used, the switched ground output of inverter Q761 energizes the relay. Two form "C" contacts permit connections for special applications.

Output switch Q762 is turned "off" when the proper tone is decoded. Before the tone is decoded, the stage provides a ground output at pin 18 to inhibit the squelch gate in repeater stations. When the tone is decoded, the ground is removed and th squelch gate is enabled. For applications whe the single-tone decoder module does not control t squelch gate, jumper JU6 is removed.

Two test switches are provided on the face o the module to facilitate servicing. ON-TEST switc S751 is placed in the ON position for normal oper tion. In the TEST position, it simulates th application of the proper tone input and actuates the decoder. If the module is jumpered for th "non-lock" mode of operation, the decoder deactivates when the switch is returned to the ON position (after a 5-second delay if jumper JU1 is used). If the module is jumpered for the "lock" mode of operation, the decoder remains activated when the switch is returned to the ON position. Momentarily placing the ON-RESET switch to the RESET position will deactivate the decoder.

4. MAINTENANCE AND TROUBLESHOOTING

a. Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A Servicing Board Kit, and insert the module into this service extension. All points on the module are now accessible fo voltage measurements, waveform observations, o other test functions.

Servicing information as given in the "Servicing the Module out of the Chassis" paragraph is applicable to the module when connected to the service board if the jumpers are connected identically. Differences in operation due to jumper changes are described in the "Circuit Operation" paragraphs of this section. Refer to these paragraphs and note jumper placements to determine the modules specific functions. For example, JU1 connecte and JU2 removed will delay module reset for approximately 5 seconds. JU2 connected will cause the module to operate in the "lock" mode.

b. Servicing the Module Out of the Chassis

Servicing may be done without connection to a remote control chassis if the proper power and terminations are connected to the module. A convenient method of connection is through the use of a TEK-38 Base Station Module Servicing Adapter The module is simply plugged into the 24-pin male plug of the adapter. Connections are then made

to the circuit module via the adapter using the standard and/or resistor push on patch leads supplied with the adapter.

(1) Remove the single-tone decoder module and check the jumpers at this time for correctness in this module's mode of operation. Note any errors and continue with the test procedure.

Place the jumpers on the module as follows:

JU1 - OUT
JU2 - OUT
JU3 - IN
JU4 - OUT
JU5 - IN
JU6 - IN
JU7 - IN

(2) Set up the test equipment as shown in the Test Set Up Diagram.

(3) Perform an overall module operation check by injecting the proper single-tone frequency on pin 3. Pin 18 should be at A+ and remain there after approximately 300 milliseconds. Removal of the single-tone frequency should immediately cause pin 18 to go to ground potential.

If the output is abnormal, proceed to step (4).

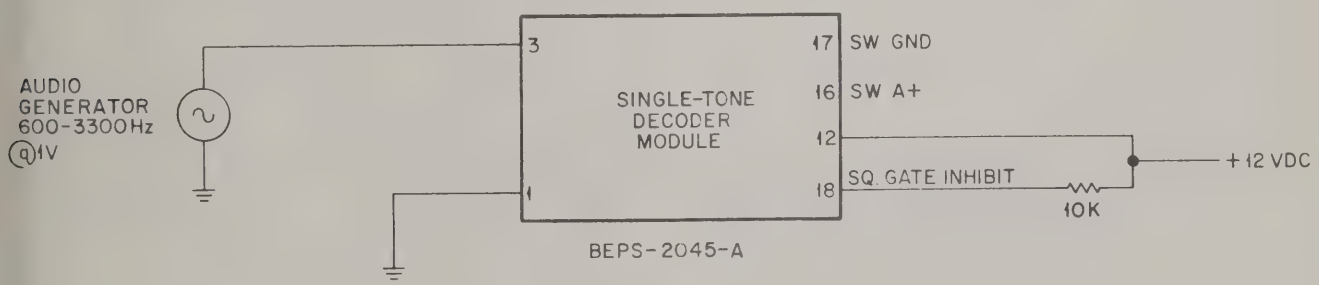
(4) Place the ON-TEST switch in the TEST position. Pins 16 and 18 should read A+ and pin 17 should read ground potential.

Return the switch to the ON position. Pins 16 and 18 should drop to near 0 volts and pin 17 should go to A+.

If all voltages are abnormal, check the dc voltages in switches Q756 and Q757, Schmitt trigger Q758 and Q759, and switch Q760. If pin 16 is normal but pins 17 and 18 are abnormal, check Q761. If only pin 18 is abnormal, check Q762. Correct the trouble and recheck step (3).

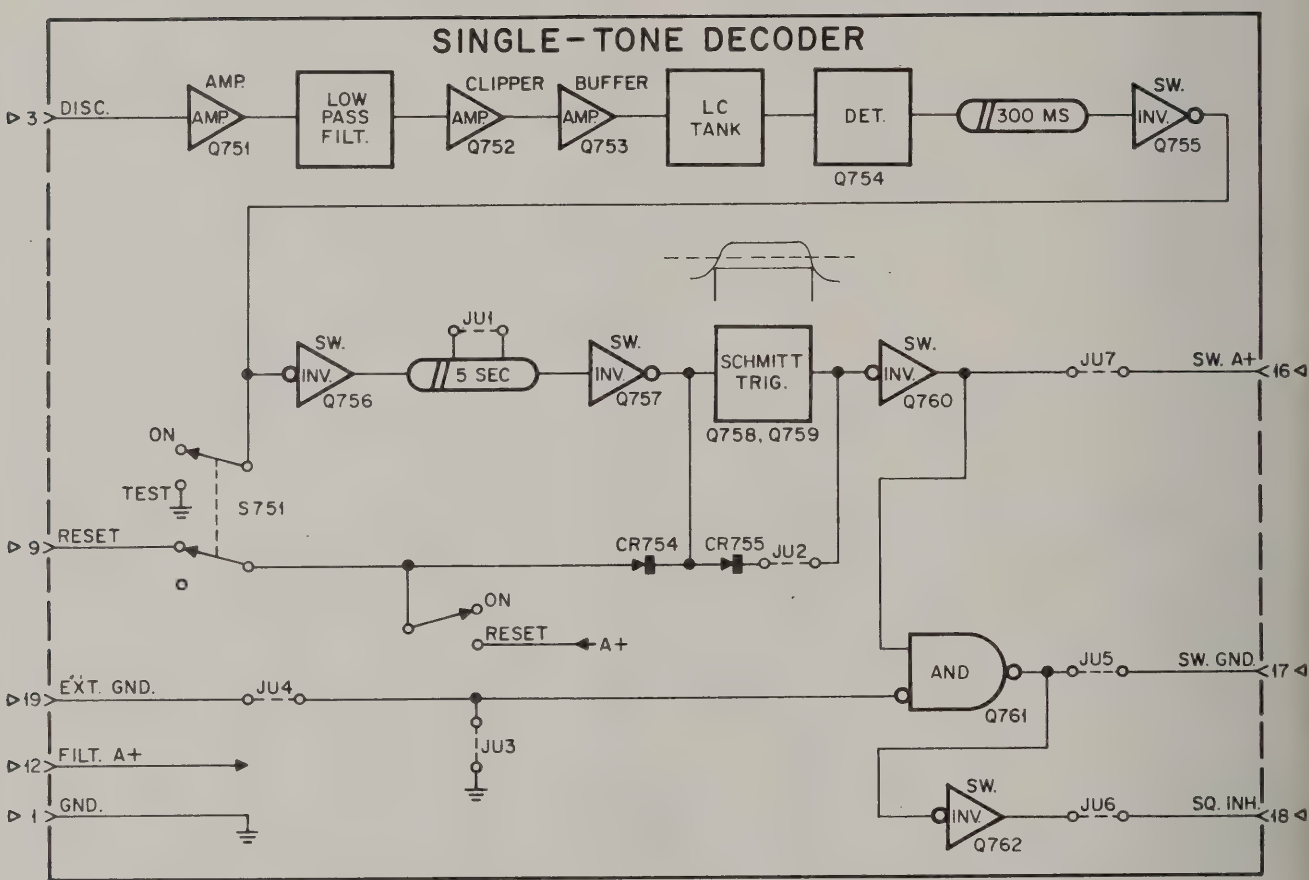
If all voltages are normal, stages Q756 through Q762 are operating satisfactorily. Proceed to step (5).

(5) Inject the proper single-tone frequency at pin 3. Measure waveforms and voltages as shown on the schematic diagram for stages Q751 through Q755. Correct any trouble and recheck step (3).



Test Set Up Diagram

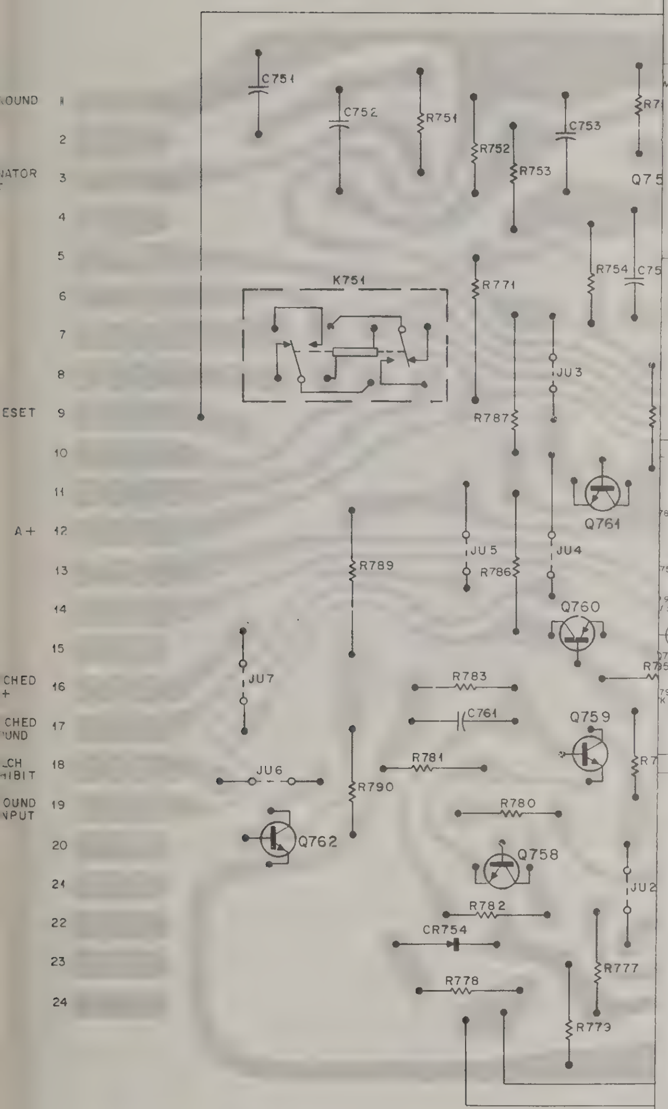
SINGLE-TONE DECODER MODULE

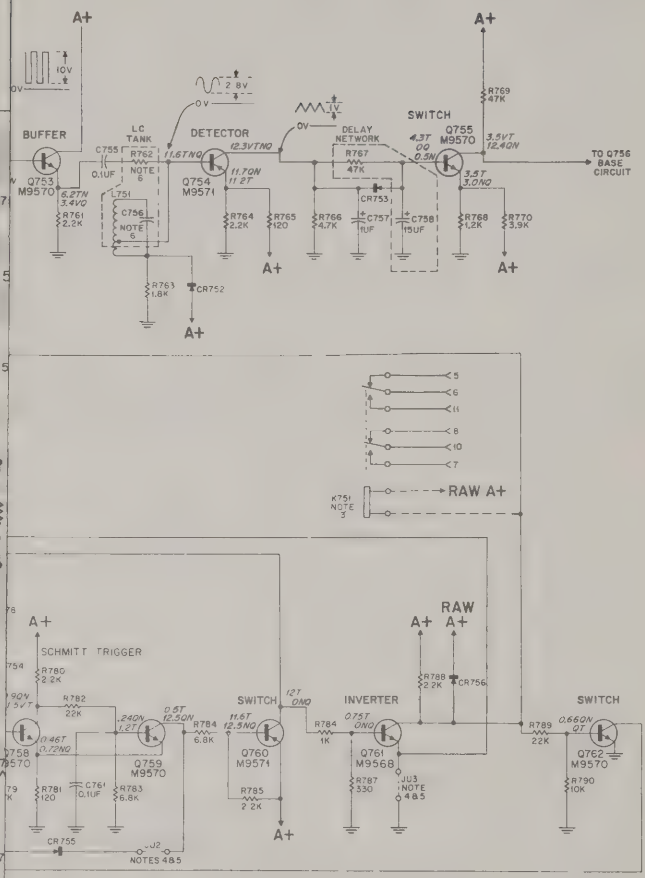


NOTE: JU1 IS INSTALLED FOR 5-SECOND TURN-OFF DELAY.
NO TURN-OFF DELAY IF JU1 IS CUT.
JU2 IS INSTALLED FOR LOCK MODE.

CEPS-5837-0

Functional Block Diagram





NOTES

1. UNLESS OTHERWISE STATED
   RESISTOR VALUES ARE IN OHMS (K = 1000)
   CAPACITOR VALUES ARE IN MICROFARADS.
2. VOLTAGE INDICATED EXISTS FOR FOLLOWING CONDITION OR COMBINATION OF CONDITIONS.
   N = NOISE
   Q = QUIETING
   T = TONE
3. TLN4151A RELAY IS OPTIONAL ACCESSORY. REFER TO ACCOMPANYING GRAPH FOR RELAY CONTACT RATINGS.
4. JUMPER CONNECTIONS TABLE FOR REPEATER OPERATION.

JUMPER	REPEATER (RT)	COMMUNITY REPEATER (RT)
JU1	OUT	OUT
JU2	IN	IN
JU3	IN	IN
JU4	OUT	OUT
JU5	OUT	IN
JU6	IN	OUT
JU7	OUT	OUT

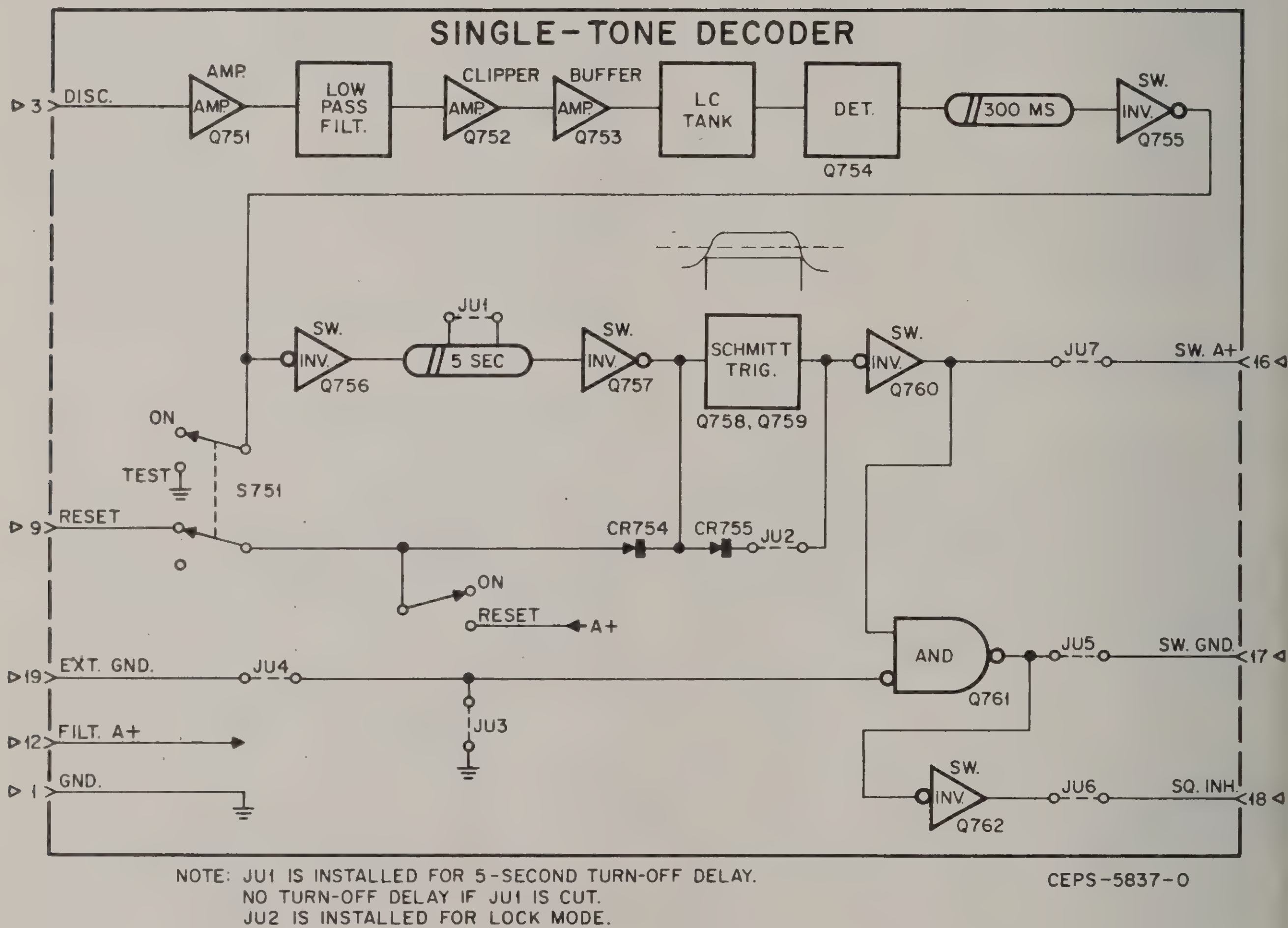
5. SPECIAL APPLICATIONS ONLY. REFER TO TEXT.
6. FREQUENCY-DETERMINING COMPONENT. SEE PARTS LIST FOR VALUE.
7. APPROXIMATELY 300 MILLISECONDS.
8. VOLTAGE READINGS AND WAVEFORMS ARE ±20%.

EPS-2046-A

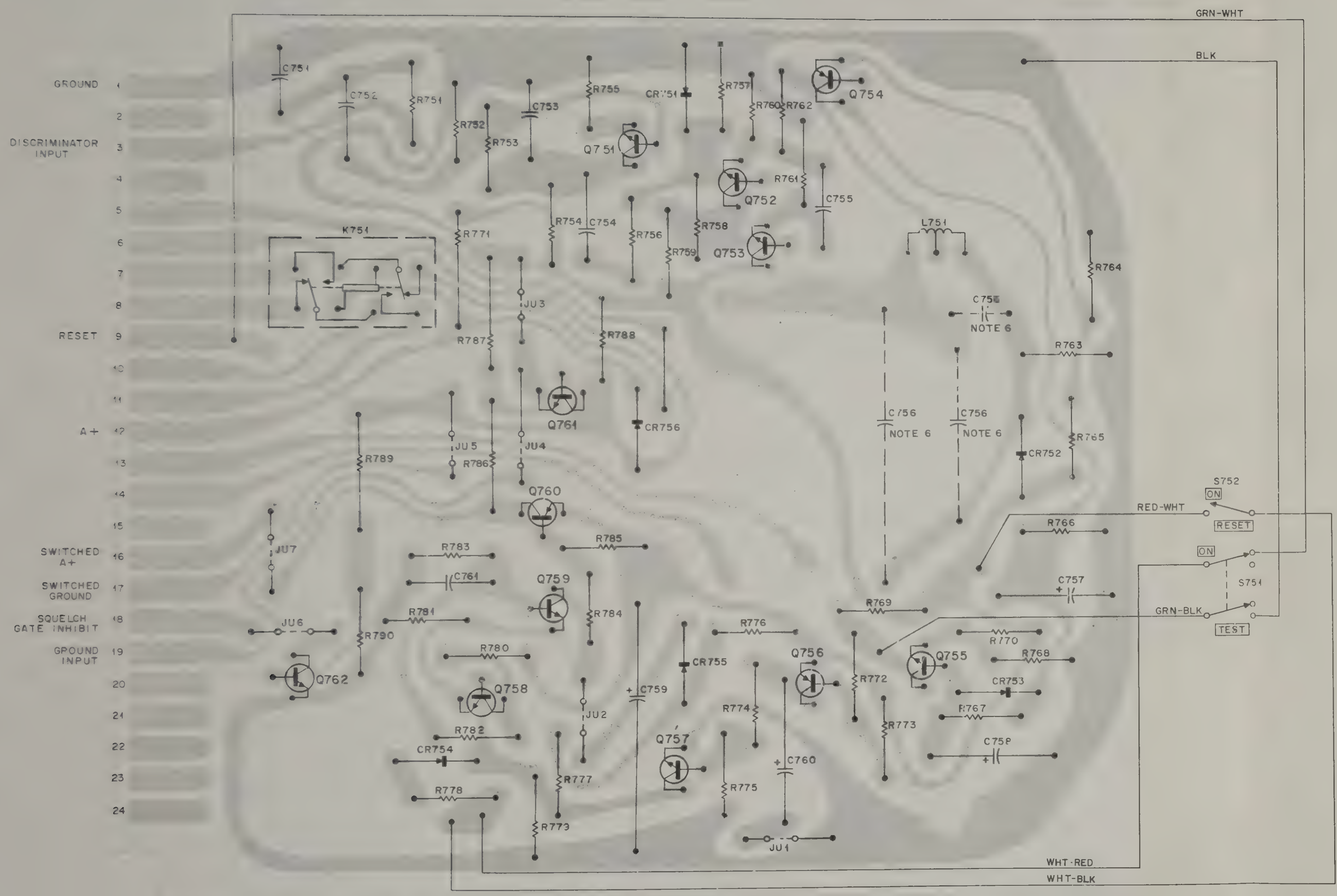
SINGLE-TONE DECODER MODULE

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

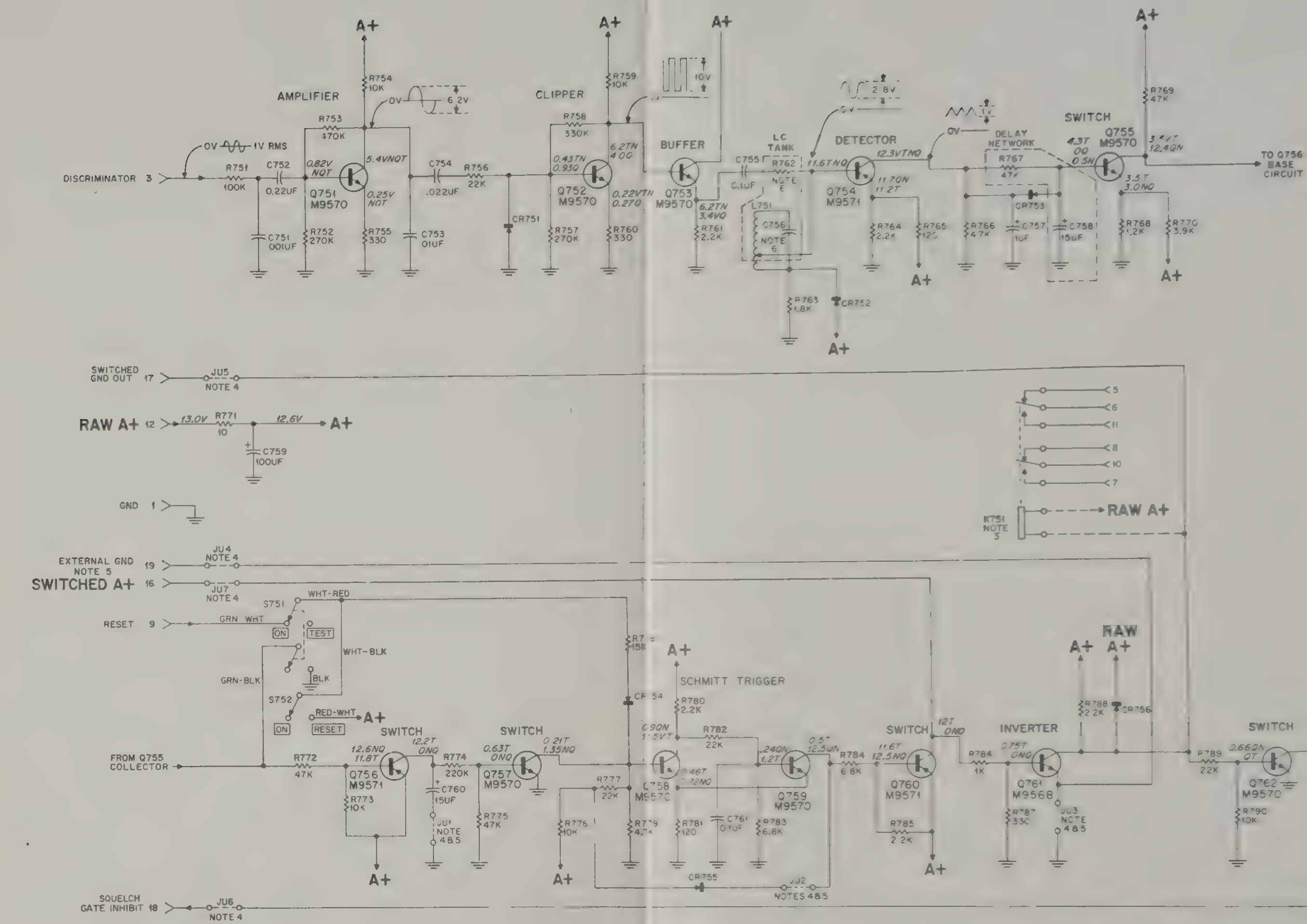
TLN1181A Single-Tone Decoder Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81005E68-F
3/1/72-UP



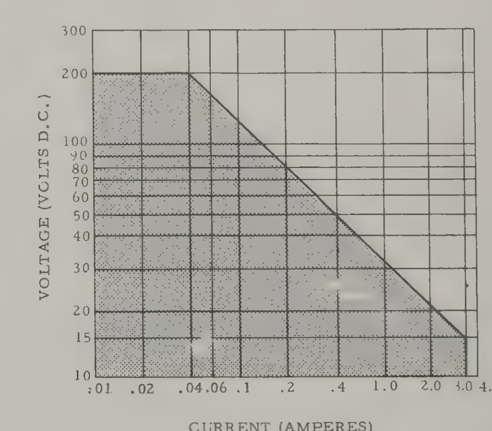
Functional Block Diagram



OL-DEPS-2027-A



DEPS-1985-B



LOAD MUST BE IN SHADED AREA

AEPS-1527-O

NOTES

1. UNLESS OTHERWISE STATED
RESISTOR VALUES ARE IN OHMS (K = 1000)
CAPACITOR VALUES ARE IN MICROFARADS.
2. VOLTAGE INDICATED EXISTS FOR FOLLOWING CONDITION OR COMBINATION OF CONDITIONS
N - NOISE
Q - QUIETING
T = TONE
3. TLN4151A RELAY IS OPTIONAL ACCESSORY. REFER TO ACCOMPANYING GRAPH FOR RELAY CONTACT RATINGS.
4. JUMPER CONNECTIONS TABLE FOR REPEATER OPERATION.

JUMPER	REPEATER (RT)	COMMUNITY REPEATER (RT)
JU1	OUT	OUT
JU2	IN	IN
JU3	IN	IN
JU4	OUT	OUT
JU5	OUT	IN
JU6	IN	OUT
JU7	OUT	OUT

5. SPECIAL APPLICATIONS ONLY. REFER TO TEXT.
6. FREQUENCY-DETERMINING COMPONENT. SEE PARTS LIST FOR VALUE.
7. APPROXIMATELY 300 MILLISECONDS.
8. VOLTAGE READINGS AND WAVEFORMS ARE ±20%.

EPS-2046-A

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLN1181A Single-Tone Decoder Module
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81005E68-F
3/1/72-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TLN4151A Relay Kit PL-457-O

K751	80C84201A01	RELAY, armature: 2 form "C"; coil res. 200 ohms ±10%

TLN8774A Panel Kit, Single-Tone Decoder PL-458-O

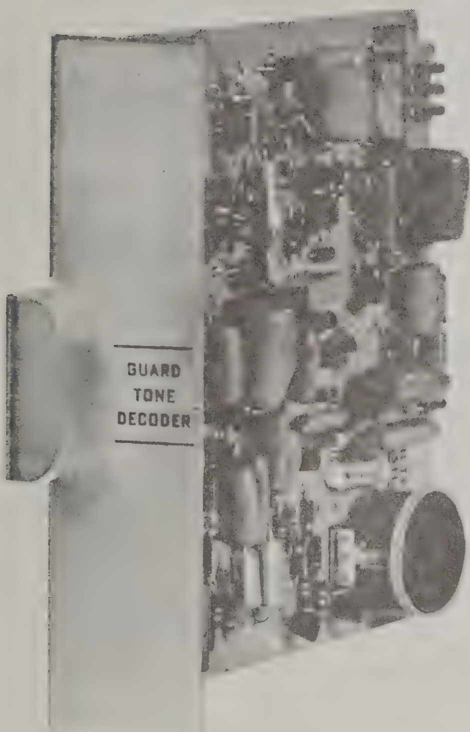
NON-REFERENCED ITEM		
	45B83914G01	GUIDE RAIL (slide-mount for circuit board); 2 req'd

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

GUARD TONE DECODER

MODEL TLN1245A



1. DESCRIPTION

The TLN1245A Guard Tone Decoder is a fully transistorized, plug-in circuit module for the tone remote control chassis of Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTION

The guard tone decoder converts a 2175-Hz guard tone signal received from a remote control source to a line push-to-talk voltage. The decoder also amplifies and distributes received function tones to other function decoders.

3. CIRCUIT DESCRIPTION

A high-level 125-millisecond burst of guard tone from a remote control point will enter the module on pin 9. The prefilter (L1-C2) through which it passes provides selectivity and protection against undesired signals and noise. Passing through Q1, Q2 and Q3, it is amplified and applied to transistor Q4, the "Vibrasponder" resonant reed driver. The "Vibrasponder" reed passes only 2175-Hz signals. The initial burst of guard tone is then further amplified by Q5 and Q6. Transistor Q6 drives Q11, connected as a peak detector, which changes the guard tone to approximately 11.4 volts dc. This dc voltage drives the push-to-talk switch, transistor Q13, through Q12. When push-to-talk occurs, the bootstrap transistor Q15, is turned off, which raises the gain of the tone decoder module 30 dB, producing a "snap" action push-to-talk function. At the same time, a large negative-going transient voltage, which resulted from the push-to-talk function, turns off transistors Q16 and Q17 for 375 milliseconds, switching the prefilter network out of the circuit so that all associated function decoders may receive function tones.

During the time the preceding has been taking place, the activity checker, Q20, through inverter Q19, is holding transistor Q18 in the "off" state because it is receiving line signals. With Q18 off, the guard tone detector (Q11) is operational. All of the preceding events have occurred in approximately 50 milliseconds.

The system is now ready to receive function tones. At the end of the initial guard tone burst

GUARD TONE DECODER MODULE

MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

PARTS LIST

TLN8773A Single-Tone Decoder Board PL-456-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 v; unl. stated
C751	21D82187B29	.001: 100 v
C752	8D82905G11	0.22
C753	8D82905G01	.01
C754	8D82905G02	.022
C755, 761	8D82905G07	0.1
C756		(see "FREQUENCY-DETERMINING COMPONENTS")
C757	23D82783B08	1 ±20%; 35 v
C758, 760	23D83214C02	15 ±20%; 25 v
C759	23D82601A25	100 +150-10%; 20 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR751 thru 756	48C82392B03	silicon
		COIL, AF:
L751	24C84200A01	1 H
		TRANSISTOR: (SEE NOTE)
Q751, 752, 753, 755, 757, 758, 759, 762	48R869570	N-P-N; type M9570
Q754, 756, 760	48R869571	P-N-P; type M9571
Q761	48R869568	N-P-N; type M9568
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R751	6S129226	100K
R752, 757	6S129227	270K
R753	6S129148	470K
R754, 759, 773, 776, 790	6S129225	10K
R755, 787	6S6022	330; 1/2 w
R756, 777, 782	6S128685	22K
R758	6S129228	330K
R760	6S129775	330
R761, 764, 780, 785, 788	6S128689	2.2K
R762		(see "FREQUENCY-DETERMINING COMPONENTS)
R763	6S129269	1.8K
R765, 781	6S129617	120
R766, 779	6S127804	4.7K
R767, 769, 772, 775	6S128902	47K
R768	6S129235	1.2K
R770	6S129232	3.9K
R771	6S5621	10; 1/2 w
R774	6S129147	220K
R778	6S127805	15K
R783, 784	6S128687	6.8K
R786	6S6229	1K; 1/2 w
R789	6S6397	22K; 1/2 w

FREQUENCY DETERMINING COMPONENTS

The frequency-determining components of this decoder are C756 and R762. In some cases, C756 consists of two capacitors connected in parallel. Refer to the following table.

C756			R762	
FREQ. (Hz)	MOTOROLA PART NO.	CAPACITOR, fixed:	MOTOROLA PART NO.	RESISTOR, fixed: ±10%; 1/4 w;
600	8D84326A27	.0557uF ±20%; 50 v	6S127803	1.5K
	&8D84326A06	.0095 uF ±3%; 50 v		
750	8D84326A26	.0420 uF ±2%; 50 v	6S127803	1.5K
900	8D84326A24	.0261 uF ±2%; 50 v	6S128689	2.2K
	&8D84326A02	.0030 uF ±3%; 50 v		
1050	8D84326A23	.0213 uF ±2%; 50 v	6S129231	3.3K
1200	8D84326A08	.0158 uF ±3%; 50 v	6S129231	3.3K
	&21K859947	510 pF ±5%; 500 v		
1350	8D84326A20	.0129 uF ±2%; 50 v	6S127804	4.7K
1500	8D84326A18	.0098 uF ±2%; 50 v	6S128687	6.8K
	&21K848236	650 pF ±5%; 300 v		
1650	8D84326A17	.00865 uF ±2%; 50 v	6S128687	6.8K
1800	8D84326A05	.0073 uF ±3%; 50 v	6S129225	10K
1950	8D84326A14	.0062 uF ±2%; 50 v	6S129225	10K
2100	8D84326A30	.0045 uF ±1%; 50 v	6S127805	15K
	&21K873269	820 pF ±2%; 300 v		
2250	8D84326A30	.0045 uF ±1%; 50 v	6S127805	15K
	&21K840047	150 pF ±5%; 500 v		
2400	8D84326A03	.0042 uF ±3%; 50 v	6S128904	18K
2550	8D84326A02	.0030 uF ±3%; 50 v	6S128685	22K
	&21K848236	650 pF ±5%; 300 v		
2700	8D84326A02	.0030 uF ±3%; 50 v	6S128685	22K
	&21K859942	220 pF ±5%; 500 v		
2850	8D84326A02	.0030 uF ±3%; 50 v	6S128685	22K
3000	8D84326A01	.0021 uF ±5%; 500 v	6S127806	27K
	&21K859947	510 pF ±5%; 500 v		
3150	8D84326A01	.0021 uF ±5%; 50 v	6S127807	33K
	&21K859178	270 pF ±5%; 300 v		
3300	8D84326A01	.0021 uF ±5%; 500 v	6S127807	33K

TLN4151A Relay Kit PL-457-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
K751	80C84201A01	RELAY, armature: 2 form "C"; coil res. 200 ohms ±10%

TLN8774A Panel Kit, Single-Tone Decoder PL-458-O

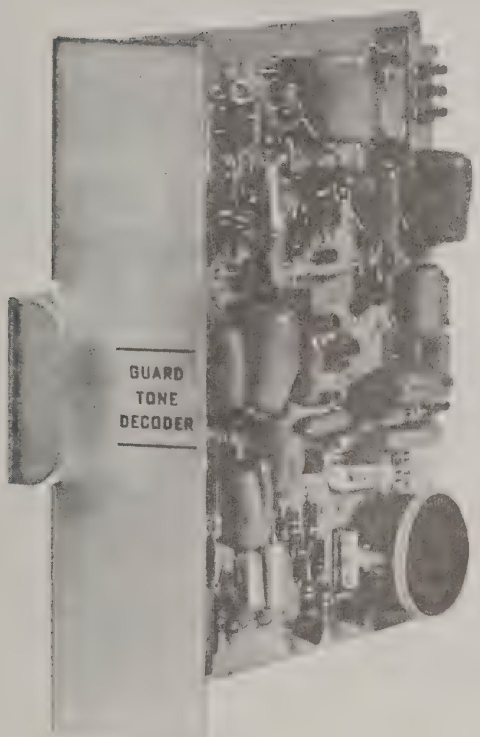
NON-REFERENCED ITEM		
	45B83914G01	GUIDE RAIL (slide-mount for circuit board); 2 req'd

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

GUARD TONE DECODER

MODEL TLN1245A



1. DESCRIPTION

The TLN1245A Guard Tone Decoder is a fully transistorized, plug-in circuit module for the tone remote control chassis of Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTION

The guard tone decoder converts a 2175-Hz guard tone signal received from a remote control source to a line push-to-talk voltage. The decoder also amplifies and distributes received function tones to other function decoders.

3. CIRCUIT DESCRIPTION

A high-level 125-millisecond burst of guard tone from a remote control point will enter the module on pin 9. The prefilter (L1-C2) through which it passes provides selectivity and protection against undesired signals and noise. Passing through Q1, Q2 and Q3, it is amplified and applied to transistor Q4, the "Vibrasponder" resonant reed driver. The "Vibrasponder" reed passes only 2175-Hz signals. The initial burst of guard tone is then further amplified by Q5 and Q6. Transistor Q6 drives Q11, connected as a peak detector, which changes the guard tone to approximately 11.4 volts dc. This dc voltage drives the push-to-talk switch, transistor Q13, through Q12. When push-to-talk occurs, the bootstrap transistor Q15, is turned off, which raises the gain of the tone decoder module 30 dB, producing a "snap" action push-to-talk function. At the same time, a large negative-going transient voltage, which resulted from the push-to-talk function, turns off transistors Q16 and Q17 for 375 milliseconds, switching the prefilter network out of the circuit so that all associated function decoders may receive function tones.

During the time the preceding has been taking place, the activity checker, Q20, through inverter Q19, is holding transistor Q18 in the "off" state because it is receiving line signals. With Q18 off, the guard tone detector (Q11) is operational. All of the preceding events have occurred in approximately 50 milliseconds.

The system is now ready to receive function tones. At the end of the initial guard tone burst

MOTOROLA INC. Communications Division
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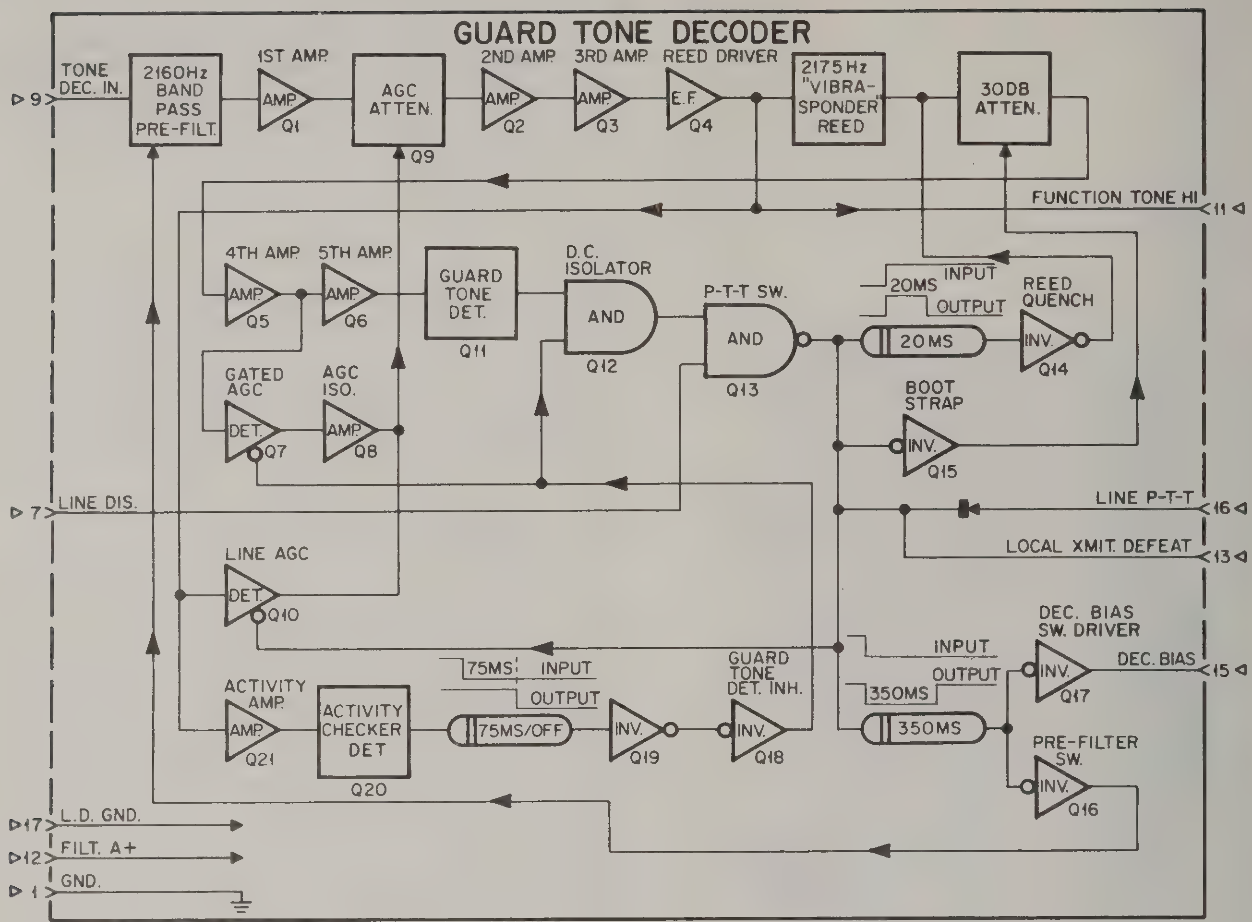


CEPS-5892-0

Functional Block Diagram

(125 milliseconds), a 40-millisecond function tone is sent by the remote control unit, amplified by the guard tone decoder transistors (Q1, Q2, Q3, and Q4) and then distributed to all function decoders. If a transmission is in progress, the guard tone resumes and continues to drive transistor Q11, providing push-to-talk activation for the rest of the transmission. This guard tone level is 30 dB lower than the initial burst, but still provides full drive to transistor Q11, because Q15 is "off", and inserts 30 dB additional gain. Line P-T-T is not lost during the function tone burst, as activity checker Q20 holds on for 75 milliseconds without guard tone.

At the end of the transmission, the activity checker (Q20) ceases to receive audio signals, so it turns on transistor Q18, which turns off the unit in less than 100 milliseconds.

The Line AGC Detector (Q10) and Attenuator (Q9) stages reduce the module gain upon receipt of very strong audio signals to prevent the third amplifier stage (Q3) from clipping, which would produce harmonics that could drive the "Vibrasponder" resonant reed. The Gated AGC Detector is very slow operating, and assures proper drive to the detector stage (Q11) and activity checker (Q20) with any line loss from 0 to 30 dB. Line AGC is operative before line P-T-T is activated; gated AGC is operative only after line P-T-T.

The reed quenching circuit is activated only when push-to-talk ceases, and disables the "Vibrasponder" resonant reed for about 100 milliseconds. This quenching action is necessary because the output from the "Vibrasponder" reed decays very slowly because of its inherent high "Q".

4. MAINTENANCE AND TROUBLESHOOTING

a. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A Module Extension Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 17	Ground
9	Audio Oscillator through .1 uF
11	AC Voltmeter
12	A+ 13.6 volts dc

b. Normal Conditions

The following chart tabulates normal levels and values for proper operation of the guard tone decoder module. Excessive deviations from these values indicate abnormal conditions.

FUNCTION	TYPICAL VALUE
Pull-In Line Level @ 2175 Hz	-41 dBm
Drop-Out Line Level @ 2175 Hz	-61 dBm
P-T-T Turn-On Time	Less Than 100 milliseconds
P-T-T Turn-Off Time	Less Than 100 milliseconds
Prefilter Switch Time	375 milliseconds
Gated AGC Threshold	-55 dBm
Line AGC Threshold	-28 dBm
Prefilter Frequency	2160 Hz
"Vibrasponder" Frequency	2175 Hz

c. Module Malfunction Location Techniques

(1) Inject a 15-millivolt, 2175 Hz audio tone into pin 9.

(2) Measure the dc voltage from pin 13 to ground. As the tone input voltage reaches 15 millivolts, pin 13 should go to ground. If the ground does not occur, check voltages on transistors Q1 through Q6, Q11, Q12 and Q13.

(3) Connect an ac voltmeter across pin 11 and ground, and a dc voltmeter to pin 13 and ground. With an accurate 2175 Hz tone injected at pin 9, pin 13 should go to ground, and remain. When pin 13 is at ground, the output level at pin 11 should remain constant at 180 millivolts ±3 dB when the input level is slowly varied from 3 millivolts to 80 millivolts. If this does not occur, check Q1, Q2, Q3, Q4, and Q5, Q7, Q8, Q9.

(4) Ground the base of the Q16 prefilter switch. With the ac voltmeter connected to pin 11, inject a 2000 Hz tone into pin 9. As the input level is raised to 40 millivolts ±3 dB, the level measured at pin 11 should reach approximately 3 volts ac and then level off. With proper operation, increasing the input at pin 9 to 4 volts ac should cause only a 2 dB increase in the level at pin 11 from that with the 40 millivolt input. IF STEP 3 WAS OK AND STEP 4 DID NOT OPERATE, CHECK Q10.

(5) Repeat steps (1) and (2) with an accurate 2175 Hz tone. To check the drop-out level, slowly reduce the input at pin 9 until the voltage at pin 13 goes to the A+ level. Measure the ac voltage at pin 9. An extra attenuator may be required, since the dropout level is typically less than -60 dBm (1 mV).

SYMPTOM

KEYS ONLY MOMENTARILY ON TRANSMIT COMMAND

TROUBLESHOOT BOOTSTRAP (Q15), AND GATED AGC (Q7-8)

NO

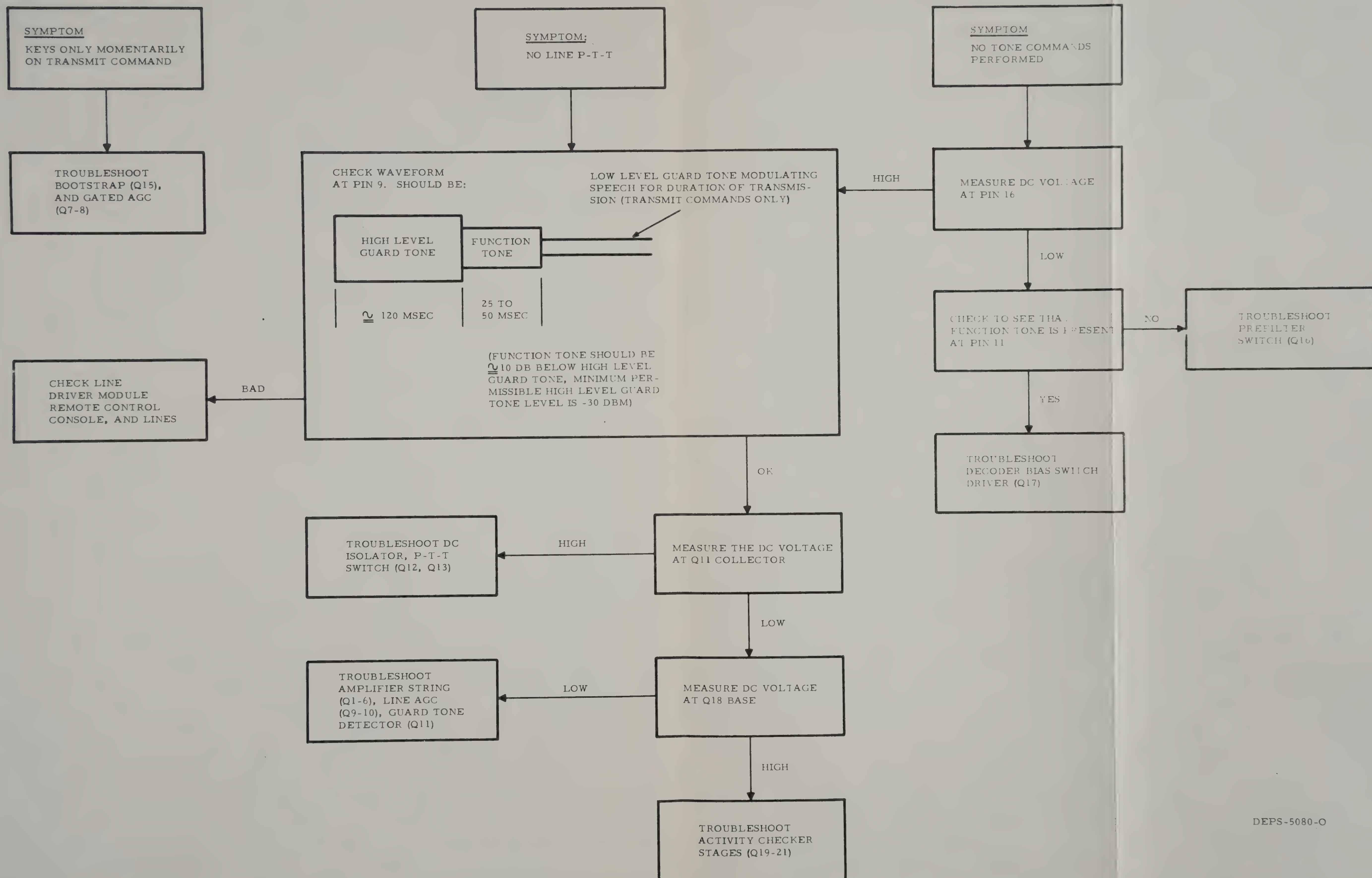
TROUBLESHOOT PREFILTER SWITCH (Q16)

B

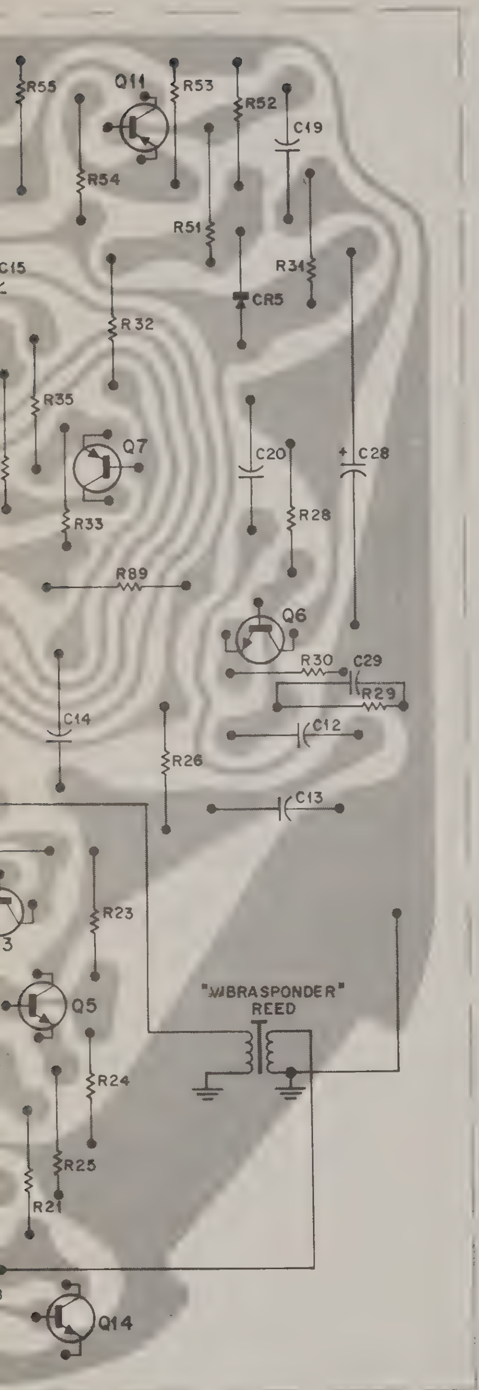
CHECK LINE DRIVER MODULE REMOTE CONTROL CONSOLE, AND LINES

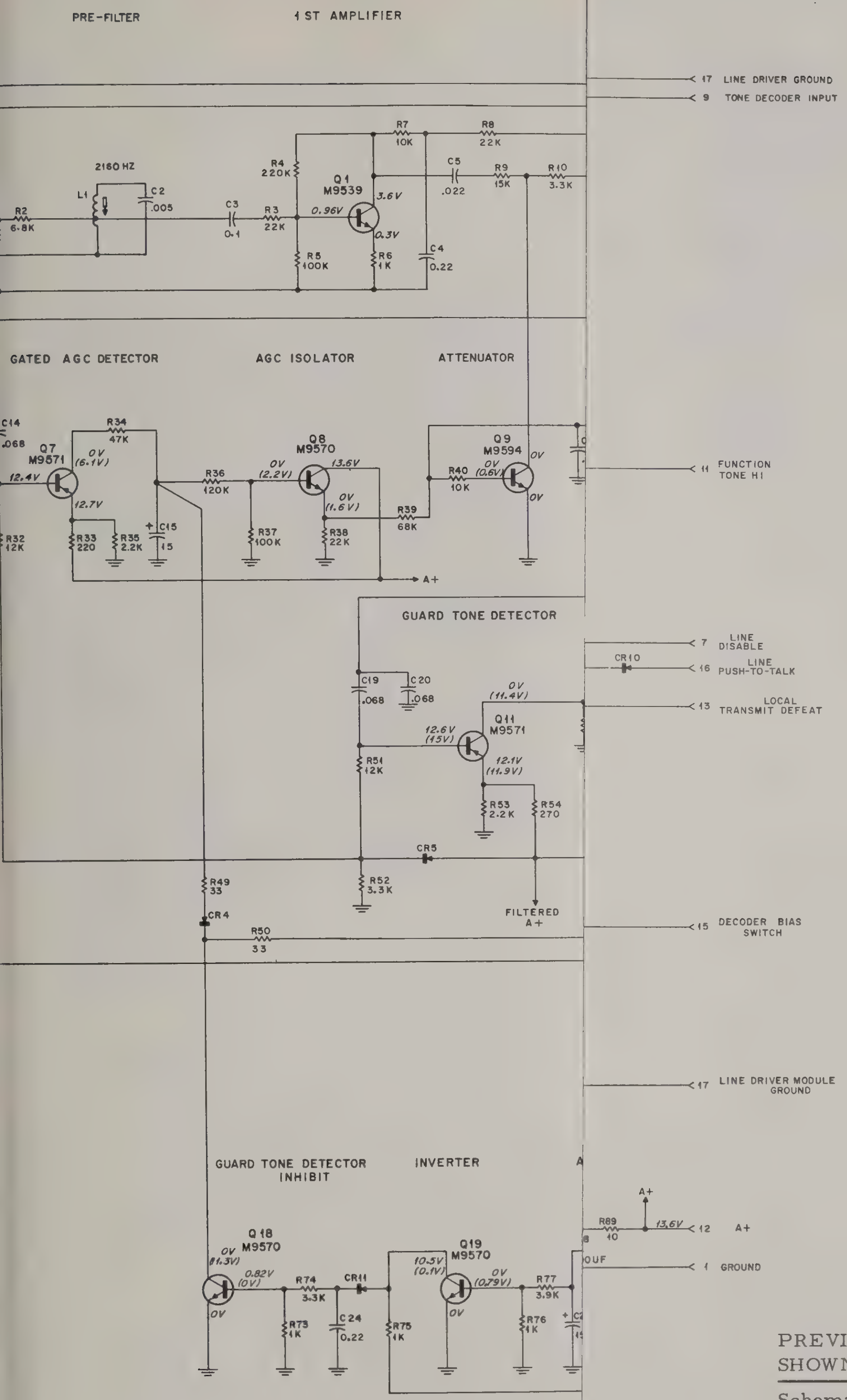
GUARD TONE DECODER MODULE

TROUBLESHOOTING CHART



DEPS-5080-O

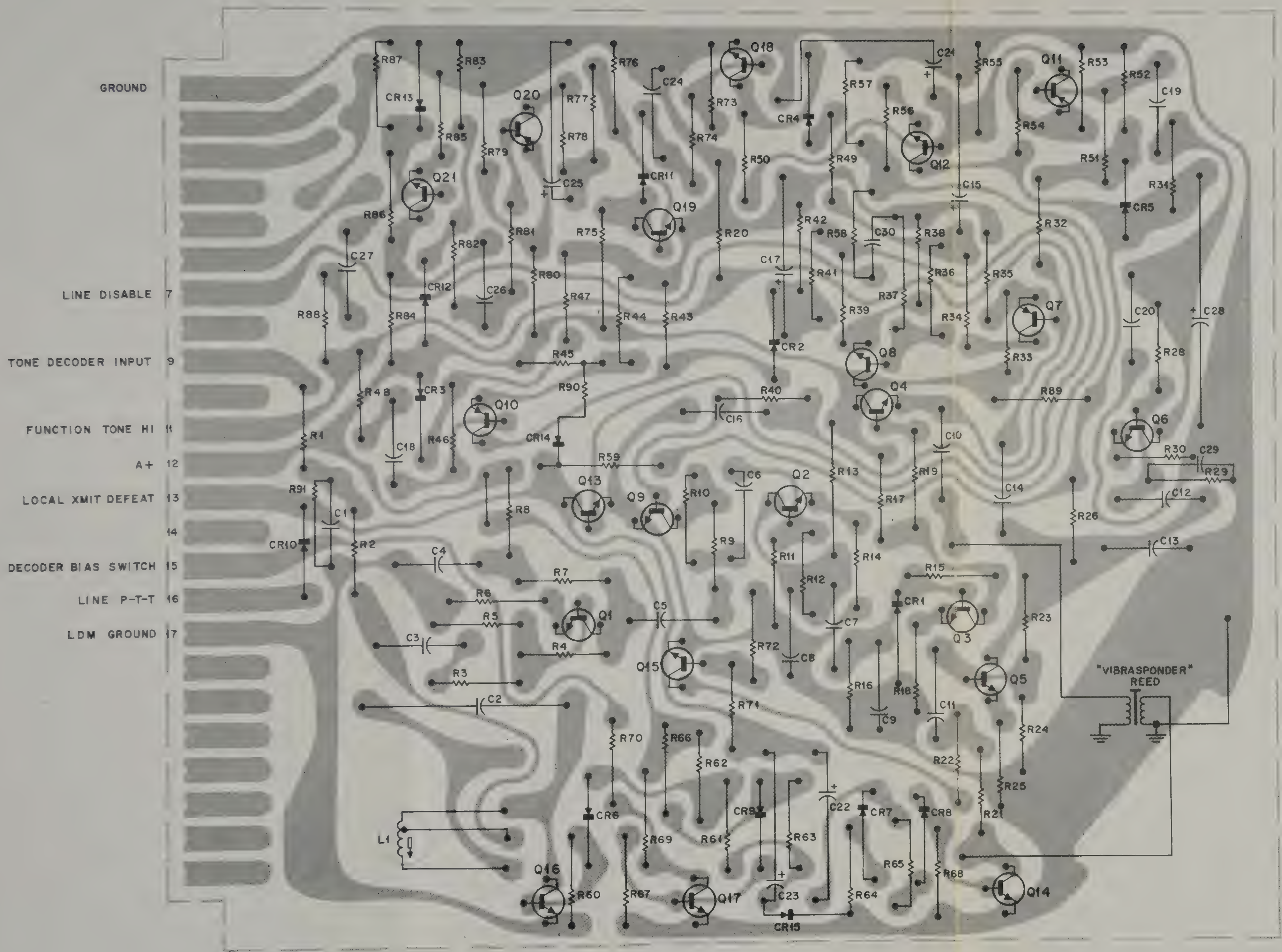

R55
Q11
R53
R52
C19
R54
R51
C15
R34
CR5
R32
R35
Q7
C20
C28
R33
R28
R89
Q6
R30
C29
R29
C14
C12
R26
C13
R23
Q5
"VIBRASPONDER"
REED
R24
R25
R21
Q14



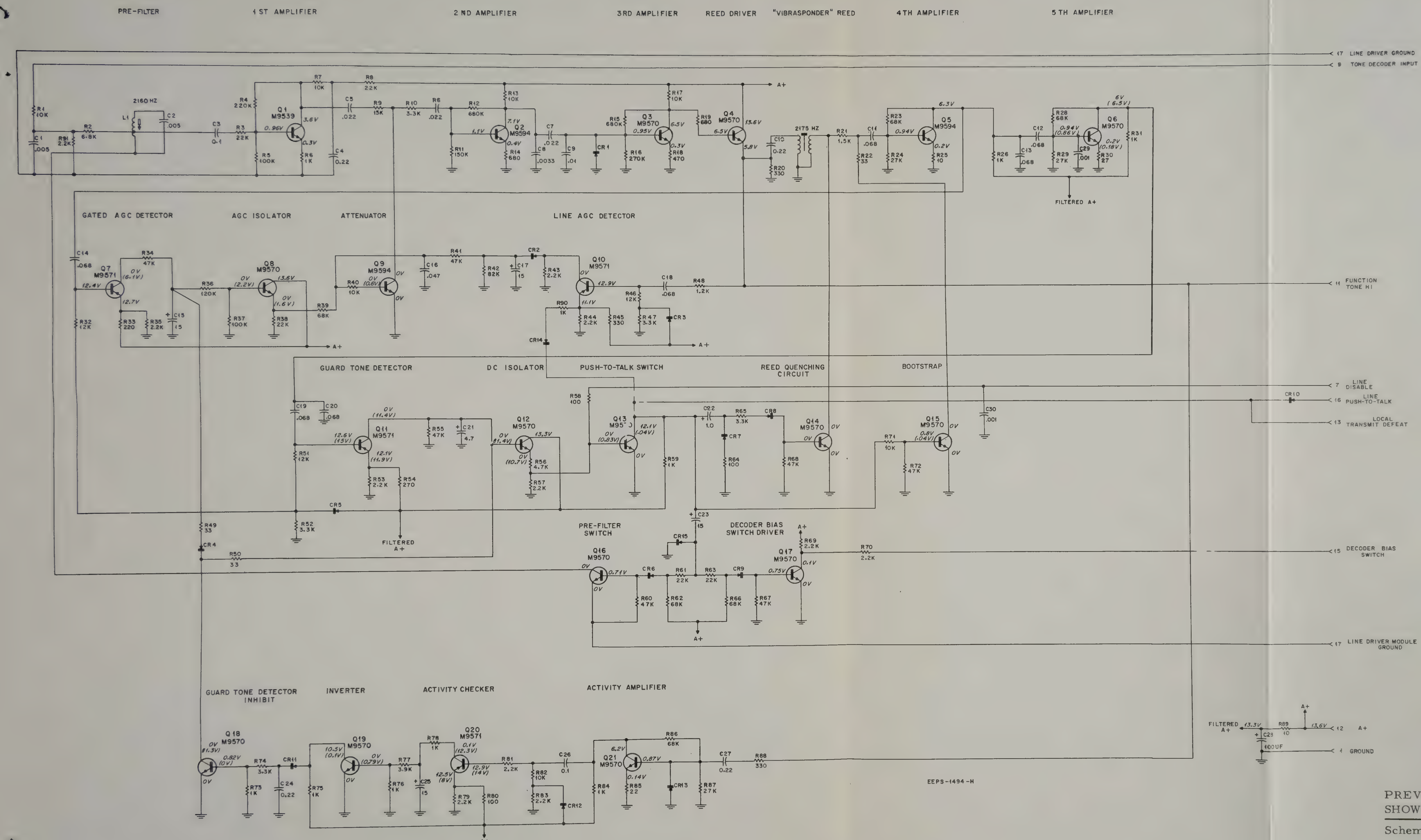
GUARD TONE DECODER MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Schematic Diagram & Circuit Board Detail
Motorola No. 63P81004E92-E
3/1/72-UP



BD-DEPS-1492-0
OL-DEPS-1493-F



GUARD TONE DECODER MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Schematic Diagram & Circuit Board Detail
Motorola No. 63P81004E92-E
3/1/72-UP

...NCE ...OL	MOTOROLA PART NO.	DESCRIPTION
	6S129886	27K ±5%
	6S131523	27 ±5%
	6S129805	1K ±5%
	6S129230	12K
	6S131275	220 ±5%
	6S128902	47K
	6S129804	2.2K ±5%
	6S128987	120K
	6S129226	100K;
	6S128685	22K
	6S129144	68K
	6S129225	10K
	6S128902	47K
	6S129145	82K
	6S128689	2.2K
	6S129804	2.2K ±5%
	6S129806	330 ±5%
	6S129230	12K
	6S129231	3.3K
	6S129708	1.2K ±5%
	6S129754	33
	6S129754	33
	6S129230	12K
	6S129231	3.3K
	6S129804	2.2K ±5%
	6S131525	270 ±5%
	6S128902	47K
	6S127804	4.7K
	6S128689	2.2K
	6S129753	100
	6S6229	1K; 1/2 W
	6S128902	47K
	6S128685	22K
	6S129144	68K
	6S128685	22K
	6S129753	100
	6S129231	3.3K
	6S129144	68K
	6S128902	47K
	6S128902	47K
	6S128689	2.2K
	6S128689	2.2K
	6S129225	10K
	6S128902	47K
	6S127804	1K
	6S129231	3.3K
	6S6229	1K; 1/2 W
	6S127802	1K
	6S129232	3.9K
	6S127802	1K
	6S129804	2.2K ±5%
	6S131524	100 ±5%
	6S128689	2.2K
	6S129225	10K
	6S128689	2.2K
	6S129805	1K ±5%
	6S124A09	22 ±5%
	6S129299	68K ±5%
	6S129886	27K ±5%
	6S129775	330
	6S129755	10
	6S127802	1K
	6S128689	2.2K

...A Guard Tone Panel Kit PL-478-O

	64B84316A01	PANEL (screened)
	45B83914G01	GUIDE, card
	3S8022	SCREW, machine: #4-40 x 1/4"; 2 used
	4S7683	LOCKWASHER: #4 int.; 2 used

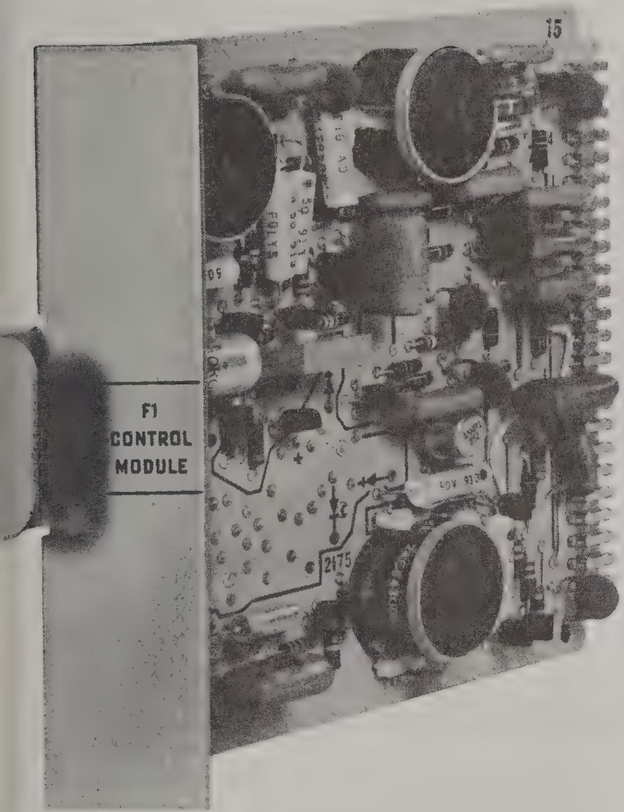
...ponder" Resonant Reed PL-479-O

	TLN6709BH	2175.0 Hz

...placement diodes and transistors must be ordered by
...torola part number only for optimum performance.

F1 CONTROL MODULE

MODEL TLN1243A



. DESCRIPTION

The TLN1243A F1 Control Module is a fully ransistorized, plug-in circuit module for the tone emote control chassis in Motorola base stations. ll components and circuitry are mounted on a turdy card with connecting terminals to mate with he interconnecting board of the chassis in which is installed.

2. FUNCTIONS

This module converts the proper tone signal from a remote control source to a grounding function to turn on the F1 channel element in the base station transmitter. The module contains notch-type audio filters to prevent spurious functions or responses.

3. CIRCUIT DESCRIPTION

In the quiescent state, all the function detectors are reverse-biased and cannot be turned on. When line push-to-talk occurs, power is applied to the F1 bistable multivibrator, Q3 and Q4, by the line control priority gate, Q5 and Q6. The bias switch, Q7, generates a function tone "window" which sets the operating bias on the F1 detector, Q2, and all other function control modules for about 375 milliseconds during line push-to-talk. Normally, the detectors are back-biased and cannot be turned on. A function tone entering on pin 14 passes through the transistor stage, Q1, operating at about a +16 dBm clipping level, which assures adequate drive to the detector stage.

When a 1950 Hz tone is received, it passes through the L1 and C4 network and into the F1 detector stage, Q2. When the tone is detected, it causes the F1 bistable multivibrator to change state, grounding the transmitter channel element via pin 3. This ground turns on the transmitter channel element and disables the Q7 detector bias switch, closing the function tone "window" to prevent the audio from falsely operating other function detectors with speech.

F1 CONTROL MODULE

MOTOROLA INC. **Communications Division**
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

REVISIONS

63P81004E92-E

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4042A	C29	ADDED .001 uF	Q6 BASE
	Q2 THRU 6	WERE 48R869570, M9570	
	Q9	WAS 48R869570	
	R9	WAS 6S129981, 3.3K	1ST. AMPLIFIER
	R11	WAS 6S131858, 270K	2ND AMPLIFIER
	R25	WAS 6S131523, 27	Q5 EMITTER
	R33	WAS 6S129804, 2.2K	Q7 EMITTER
	R35	WAS 6S131276, 150K	
	R41	WAS 6S129144, 68K	ATTENUATOR CIRCUIT
	R42	WAS 6S129242, 56K	
	R45	WAS 6S129709, 470	Q10 EMITTER
	R48	WAS 6S129981, 3.3K	Q10 BASE CIRCUIT
	R54	WAS 6S131275, 220	Q11 EMITTER
	R80	WAS 6S129431, 180	Q20 EMITTER
TLN4042A-1	Q3, Q4, Q6	WERE 48R869539, M9539	TOP OF SCHEMATIC
TLN4042A-2	C1	WAS 8D82905G26 .0047 uF	INPUT, PIN 9
	CR14	ADDED	Q10 EMITTER
	R90	ADDED	Q10 EMITTER
	R37	WAS 6S6031, 100K, 1/2 W	Q8 BASE
TLN4042A-3	C30	ADDED	LINE DISABLE PIN 7 TO GND
	R91	ADDED	INPUT, PIN 9
TLN4042A-4	C22	FROM 23K865137, 4.7 TO 23D82783B08, 1.0	Q13 BASE CIRCUIT
	CR15	ADDED	

PARTS LIST

TLN4042A Guard Tone Board — PL-477-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 V; unl. stated
C1	21D82428B15	.005; X5R
C2	8D84326A29	.005 ±2%
C3	8D82905G07	0.1
C4	8D82905G11	0.22
C5	8D82905G02	.022
C6	8D82905G02	.022
C7	8D82905G02	.022
C8	8D82905G25	.0033
C9	8D82905G01	.01
C10	8D82905G11	0.22
C11	8D82905G04	.068
C12	8D82905G04	.068
C13	8D82905G04	.068
C14	8D82905G04	.068
C15	23K865136	15 ±20%; 25 V
C16	8D82905G03	.047
C17	23K865136	15 ±20%; 25 V
C18	8D82905G04	.068
C19	8D82905G04	.068
C20	8D82905G04	.068
C21	23K865137	4.7 ±20%; 25 V
C22	23D82783B08	1.0 ±20%; 35 V
C23	23K865136	15 ±20%; 25 V
C24	8D82905G11	0.22
C25	23K865137	15 ±20%; 25 V
C26	8D82905G07	0.1
C27	8D82905G11	0.22
C28	23D82601A25	100 +150-10%; 20 V
C29	21C82187B20	.001; 100 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru	48C82392B03	silicon
		COIL, ASSEMBLY, inductor:
L1	1V80702B11	1H; incl. ground clip
		TRANSISTOR: (SEE NOTE)
Q1	48R869539	N-P-N; M9539
Q2	48R869594	N-P-N; M9594
Q3	48R869570	N-P-N; M9570
Q4	48R869570	N-P-N; M9570
Q5	48R869594	N-P-N; M9594
Q6	48R869570	N-P-N; M9570
Q7	48R869571	P-N-P; M9571
Q8	48R869570	N-P-N; M9570
Q9	48R869594	N-P-N; M9594
Q10	48R869571	P-N-P; M9571
Q11	48R869571	P-N-P; M9571
Q12 thru 19	48R869570	N-P-N; M9570
Q20	48R869571	P-N-P; M9571
Q21	48R869570	N-P-N; M9570
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R1	6S129225	10K
R2	6S128687	6.8K
R3	6S128685	22K
R4	6S124B06	220K ±5%
R5	6S124A97	100K ±5%
R6	6S129805	1K ±5%
R7	6S129668	10K ±5%
R8	6S128685	22K
R9	6S129236	15K ±5%
R10	6S129981	3.3K ±5%
R11	6S128683	150K ±5%
R12	6S131857	680K ±5%
R13	6S5556	10K ±5%; 1/2 W
R14	6S129984	680 ±5%
R15	6S131857	680K ±5%
R16	6S131858	270K ±5%
R17	6S129668	10K ±5%
R18	6S129709	470 ±5%
R19	6S128599	680
R20	6S6022	330; 1/2 W
R21	6S129681	1.5K ±5%
R22	6S124A13	33 ±5%
R23	6S129299	68K ±5%
R24	6S129886	27K ±5%
R25	6S124A01	10 ±5%
R26	6S129805	1K ±5%
R28	6S129299	68K ±5%
R29	6S129886	27K ±5%
R30	6S131523	27 ±5%
R31	6S129805	1K ±5%
R32	6S129230	12K
R33	6S131275	220 ±5%
R34	6S128902	47K
R35	6S129804	2.2K ±5%
R36	6S128987	120K
R37	6S129226	100K;
R38	6S128685	22K
R39	6S129144	68K
R40	6S129225	10K
R41	6S128902	47K
R42	6S129145	82K
R43	6S128689	2.2K
R44	6S129804	2.2K ±5%
R45	6S129806	330 ±5%
R46	6S129230	12K
R47	6S129231	3.3K
R48	6S129708	1.2K ±5%
R49	6S129754	33
R50	6S129754	33
R51	6S129230	12K
R52	6S129231	3.3K
R53	6S129804	2.2K ±5%
R54	6S131525	270 ±5%
R55	6S128902	47K
R56	6S127804	4.7K
R57	6S128689	2.2K
R58	6S129753	100
R59	6S6229	1K; 1/2 W
R60	6S128902	47K
R61	6S128685	22K
R62	6S129144	68K
R63	6S128685	22K
R64	6S129753	100
R65	6S129231	3.3K
R66	6S129144	68K
R67	6S128902	47K
R68	6S128902	47K
R69	6S128689	2.2K
R70	6S128689	2.2K
R71	6S129225	10K
R72	6S128902	47K
R73	6S127804	1K
R74	6S129231	3.3K
R75	6S6229	1K; 1/2 W
R76	6S127802	1K
R77	6S129232	3.9K
R78	6S127802	1K
R79	6S129804	2.2K ±5%
R80	6S131524	100 ±5%
R81	6S128689	2.2K
R82	6S129225	10K
R83	6S128689	2.2K
R84	6S129805	1K ±5%
R85	6S124A09	22 ±5%
R86	6S129299	68K ±5%
R87	6S129886	27K ±5%
R88	6S129775	330
R89	6S129755	10
R90	6S127802	1K
R91	6S128689	2.2K

TLN4043A Guard Tone Panel Kit — PL-478-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	64B84316A01	PANEL (screened)
	45B83914G01	GUIDE, card
	3S8022	SCREW, machine: #4-40 x 1/4"; 2 used
	4S7683	LOCKWASHER: #4 int.; 2 used

"Vibrasponder" Resonant Reed — PL-479-O

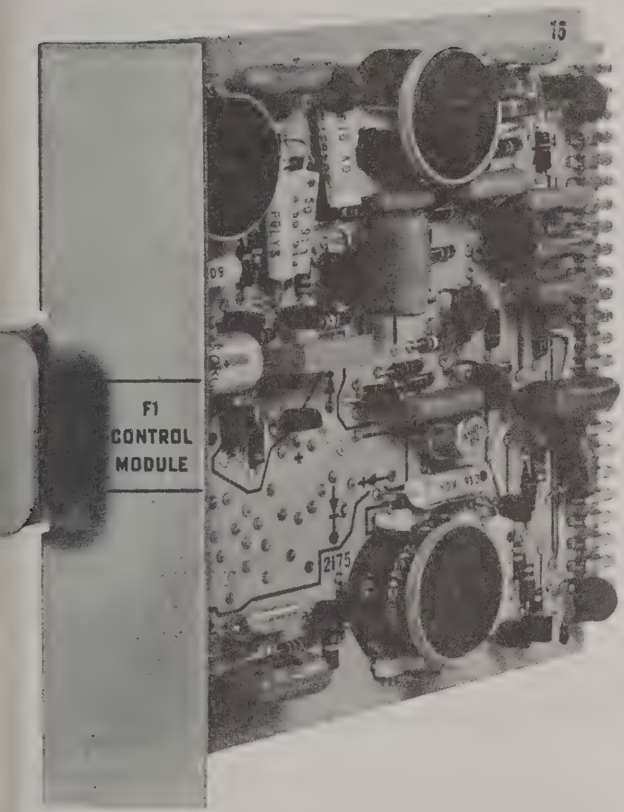
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	TLN6709BH	2175.0 Hz

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

F1 CONTROL MODULE

MODEL TLN1243A



. DESCRIPTION

The TLN1243A F1 Control Module is a fully ransistorized, plug-in circuit module for the tone emote control chassis in Motorola base stations. ll components and circuitry are mounted on a turdy card with connecting terminals to mate with ne interconnecting board of the chassis in which is installed.

2. FUNCTIONS

This module converts the proper tone signal from a remote control source to a grounding function to turn on the F1 channel element in the base station transmitter. The module contains notch-type audio filters to prevent spurious functions or responses.

3. CIRCUIT DESCRIPTION

In the quiescent state, all the function detectors are reverse-biased and cannot be turned on. When line push-to-talk occurs, power is applied to the F1 bistable multivibrator, Q3 and Q4, by the line control priority gate, Q5 and Q6. The bias switch, Q7, generates a function tone "window" which sets the operating bias on the F1 detector, Q2, and all other function control modules for about 375 milliseconds during line push-to-talk. Normally, the detectors are back-biased and cannot be turned on. A function tone entering on pin 14 passes through the transistor stage, Q1, operating at about a +16 dBm clipping level, which assures adequate drive to the detector stage.

When a 1950 Hz tone is received, it passes through the L1 and C4 network and into the F1 detector stage, Q2. When the tone is detected, it causes the F1 bistable multivibrator to change state, grounding the transmitter channel element via pin 3. This ground turns on the transmitter channel element and disables the Q7 detector bias switch, closing the function tone "window" to prevent the audio from falsely operating other function detectors with speech.

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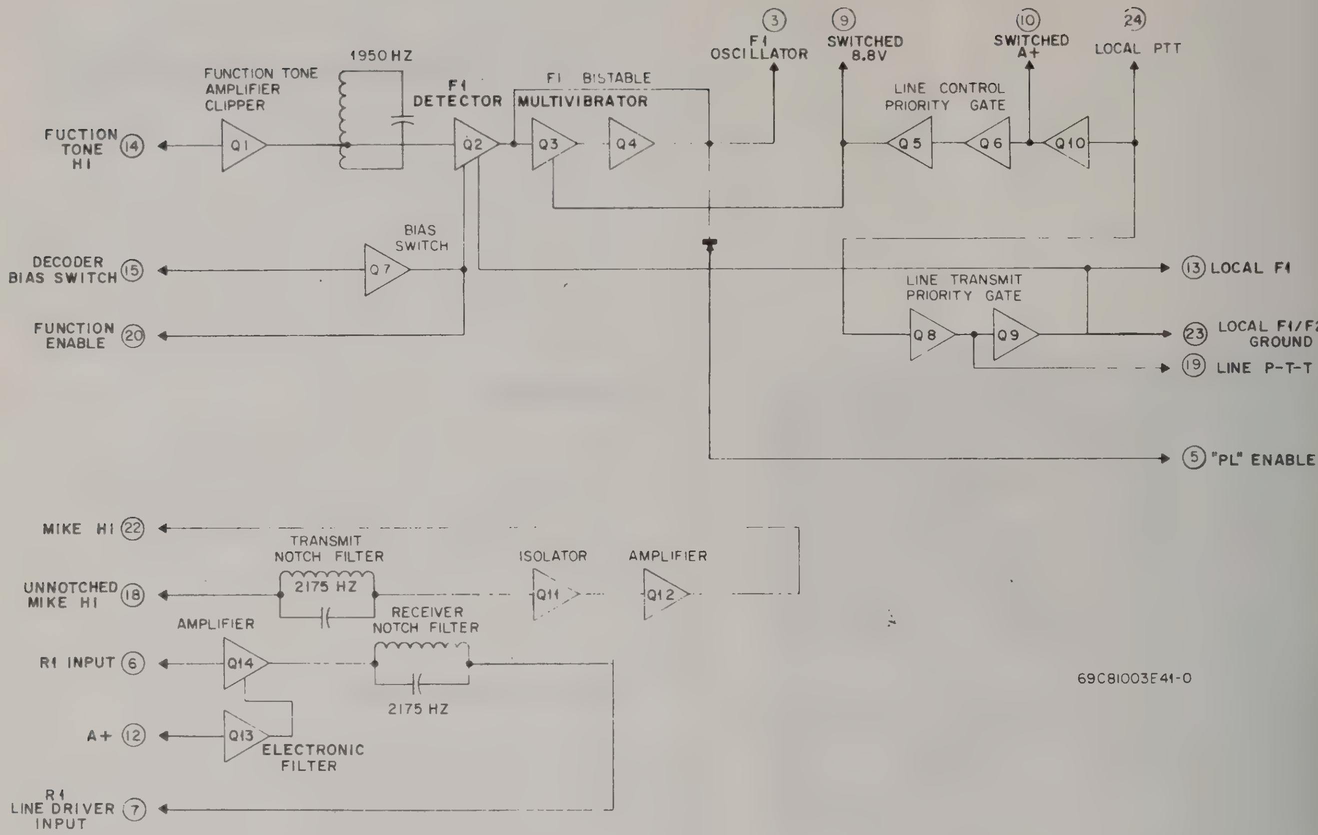


Functional Block Diagram

Local transmission direct from the base station is controlled by applying a ground to the local P-T-T terminal, pin 24. This applies power to the F1 bistable multivibrator through transistors Q10, Q5, and Q6; and causes it to change state through the line transmit priority gate, Q8 and Q9.

If while a local transmission is being made, line push-to-talk occurs, the F1 bistable multivibrator is turned off by the sudden application of the line P-T-T and local transmit defeat, causing a momentary loss of switched 8.8 volts. After the line-controlled transmission is completed, the local transmission continues.

The receiver notch filter between the receiver terminal, pin 6, and the line driver input, pin 7, prevents the guard tone decoder from generating false responses from receiver noise or speech signals by removing all 2175 Hz components. The transmit notch filter, between pins 18 and 22, prevents the 2175 Hz guard tone from modulating a line-controlled transmission. Both notch filters have a notch depth greater than 45 dB at 2175 Hz. The electronic filter, Q13, and its associated components protect the receiver notch filter from any ripple appearing on the A+ line, which might disturb this very low level stage.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To initially determine the location of the fault, operate the station locally and initiate the desired function from the module. If the desired function occurs, the module is functioning properly. If it does not occur, the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A PC Service Board, and

reinsert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module:

PIN NUMBER	CONNECTION
1, 2, 4, 17	Ground
3	10K ohms to pin 12
5	10K ohms to pin 12
10	to pin 12
11	1000 ohms to ground; 200 ohms to pin 12
12	A+; 13.6 volts dc
14	audio oscillator input
18	4.7K ohms to ground; 4.7K ohms to pin 12; .1 uF to audio oscillator
20	to pin 1
23	100K ohms to pin 11

c. Normal Conditions

The following chart tabulates normal levels and values for proper operation of the F1 Control Module. Excessive deviation from these values indicates abnormal conditions.

Function	Typical Value
Overdrive level to F1 Detector @ 1950 Hz	9 dB
Switched 8.8-volt line	0 v dc (standby) 8 v dc (transmit)
F1 Tank Circuit Frequency	1950 Hz
F1 Pull-In Bandwidth (constant amplitude)	60 Hz
Transmit Notch Frequency	2175 Hz
Receive Notch Frequency	2175 Hz
Transmit Notch Depth	Greater than 45 dB
Receive Notch Depth	Greater than 45 dB
Transmit Notch Insertion loss @ 1kHz (pin 18 to pin 22)	0 dB
Receive Notch Insertion loss @ 1 kHz (pin 6 to pin 7)	2 dB

d. Stage Malfunction Location Techniques

(1) General

To locate a malfunction within the circuit module, a locally-injected signal may be applied to the input of a tone detector stage. If the tone causes the following bistable multivibrator to turn on, the preceding function tone amplifier stage should be investigated. If the bistable multivibrator does not turn on, the detector and multivibrator should be checked for proper voltages and operation.

(2) F1 Bistable Multivibrator

(a) Connect a dc voltmeter to the collector of Q4.

(b) Inject a 1950 Hz tone into tuned circuit L1 and C4 through a coupling capacitor at a level not exceeding 1 volt.

(c) If the voltage at the collector changes to the value indicated on the schematic diagram for the operated condition, the bistable multivibrator is functioning. Look to the function tone amplifier stage for a malfunction preventing proper operation of the module.

(3) Function Tone Amplifier Stage

(a) Connect an audio oscillator to pin 14 (high) and pin 1 (ground). Set the oscillator to 1000 Hz at -10 dBm.

(b) Measure the output level at the collector of Q1. The level should be at least +10 dBm. As viewed on an oscilloscope, the waveform should be well into a clipping condition.

(c) If the previous conditions cannot be obtained, check the voltages and components of the function tone amplifier stage.

(4) Transmit Notch Filter Stage

(a) Connect the biasing resistor network to pin 18 as indicated in the table.

(b) Connect an audio oscillator across pin 17 (low side) through a .1 uF capacitor to pin 18 (high side).

(c) Connect an ac voltmeter to pins 17 and 22 to measure the output as audio is injected from the oscillator.

(d) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltage at each frequency.

(e) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the transmit notch filter stage.

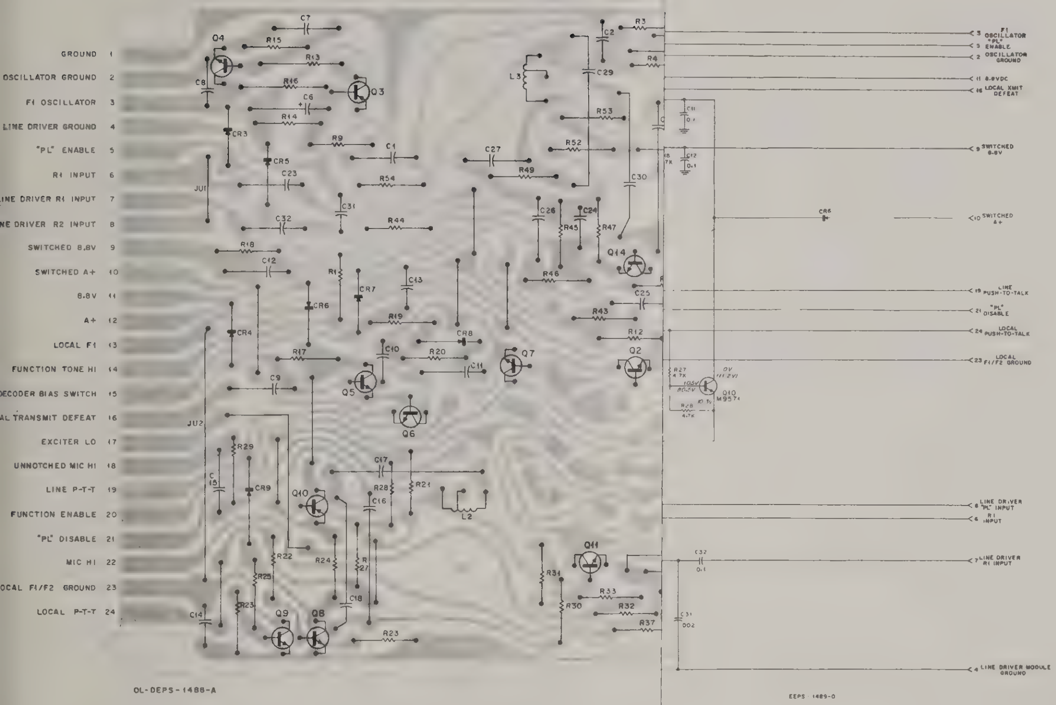
(5) Receiver Notch Filter Stage

(a) Connect an audio oscillator across pin 6 (high side) and ground.

(b) Connect an ac voltmeter between pin 7 and pin 4.

(c) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltages at each frequency.

(d) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the receiver notch filter stage.



PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Schematic Diagram
And Circuit Board Detail
Motorola No. 63P81004E??-A
3/1/72-UP

F1 CONTROL MODULE

(d) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltage at each frequency.

(e) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the transmit notch filter stage.

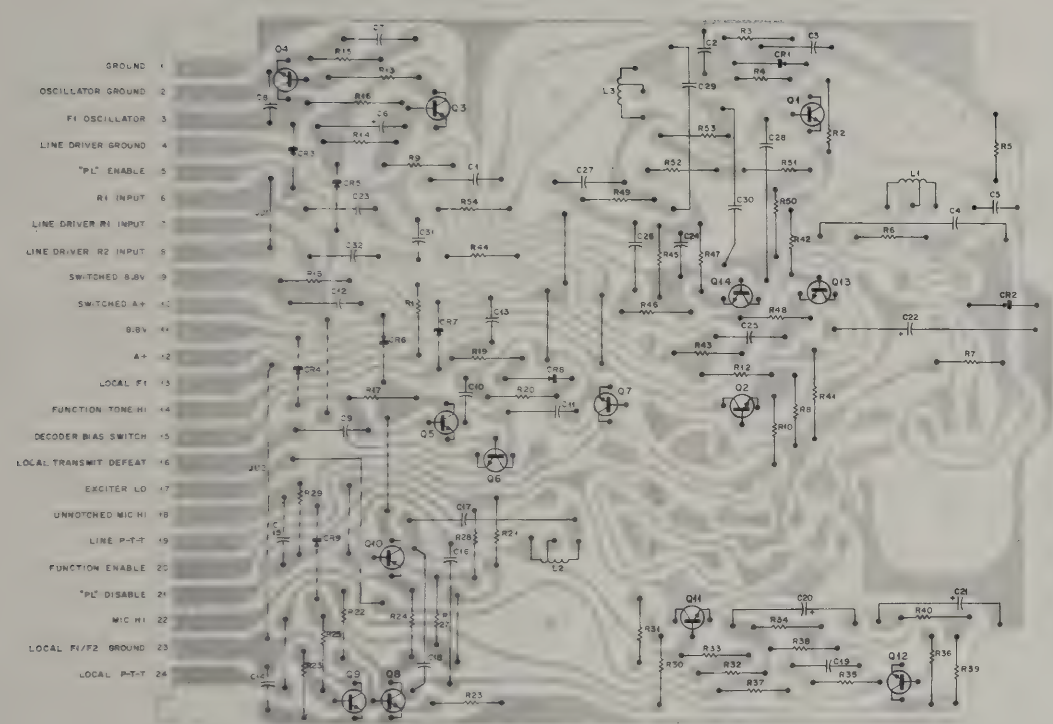
(5) Receiver Notch Filter Stage

(a) Connect an audio oscillator across pin 6 (high side) and ground.

(b) Connect an ac voltmeter between pin 7 and pin 4.

(c) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltages at each frequency.

(d) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the receiver notch filter stage.



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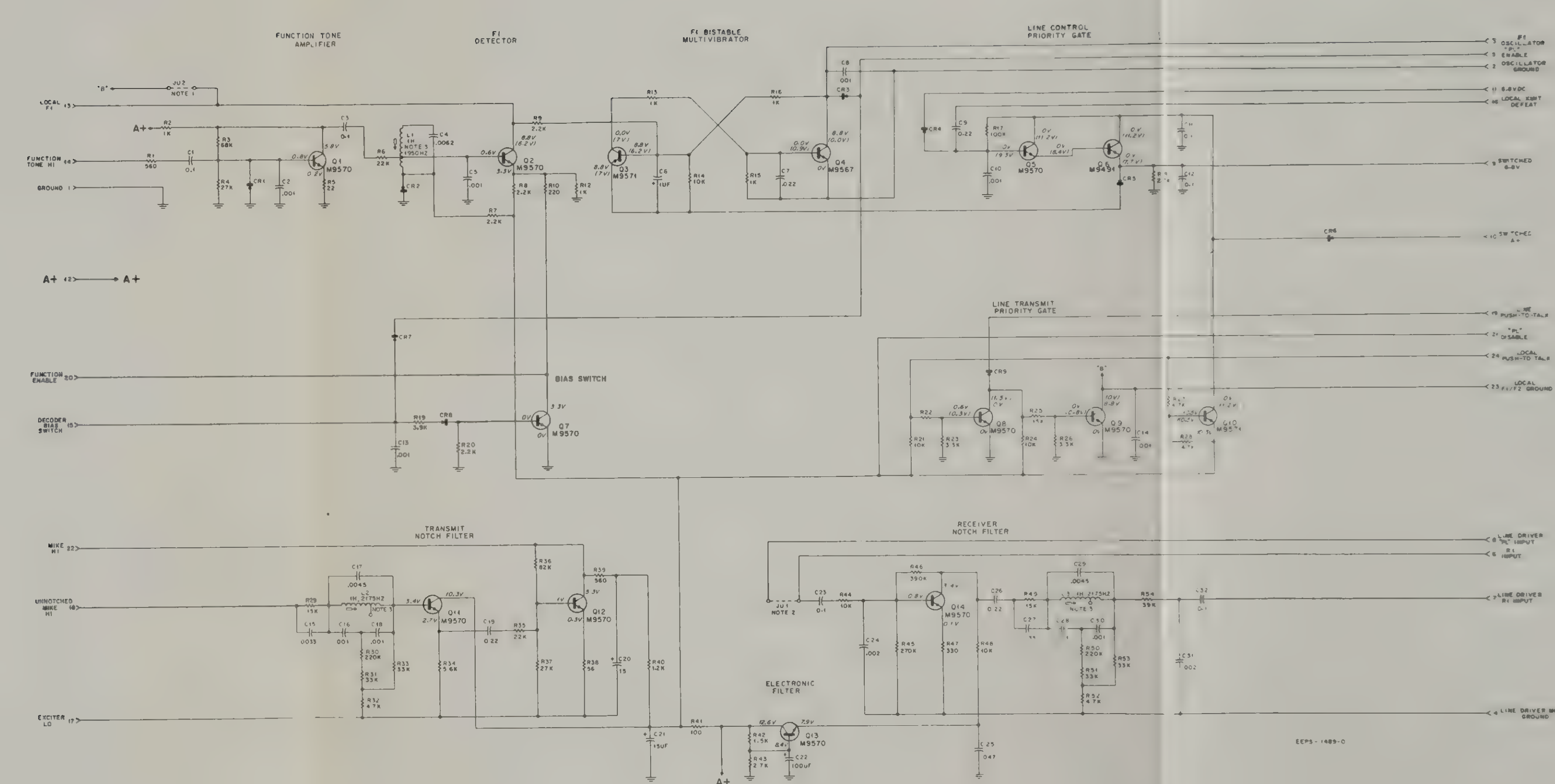


NOTES

1. JU2 REMOVED WHEN 2-FREQUENCY TRANSMITTERS ARE USED.
2. JU1 REMOVED EXCEPT ON 2-RECEIVER STATIONS WITHOUT 4-WIRE AUDIO, OR 2-RECEIVER STATIONS WITH SEPARATE TRANSMITTER AND RECEIVER AUDIO LINES.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.
4. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED CONDITION.

FPS-2104-O

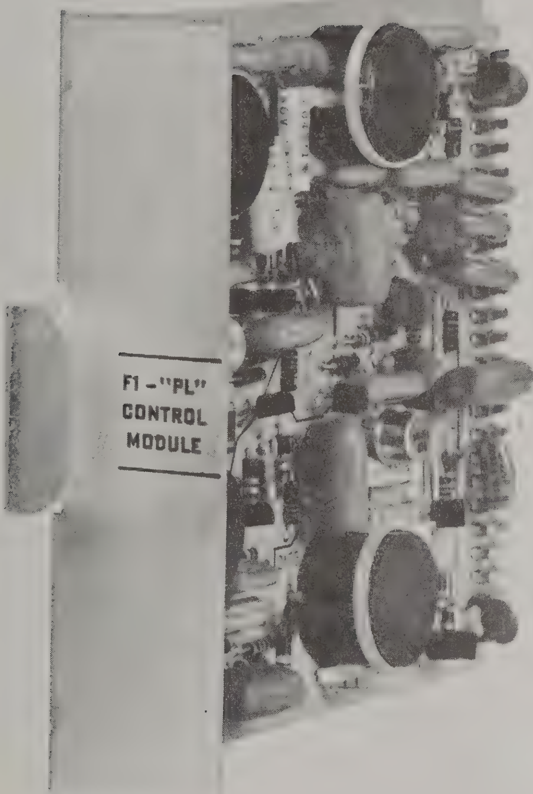
F1 CONTROL MODULE

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Schematic Diagram
And Circuit Board Detail
Motorola No. 63P81004E??-A
3/1/72-UP

F1-"PRIVATE-LINE" DISABLE CONTROL MODULE

MODEL TLN1244A



1. DESCRIPTION

The TLN1244A F1-"PL" Disable Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

The module converts the proper tone signal from a remote control source to a grounding function to turn on a transmitter channel element for frequency F1, or to disable the "Private-Line" operation of the receiver for channel monitoring before transmitting. The function is selected by the frequency of the received control tone.

3. CIRCUIT DESCRIPTION

In the quiescent state, all function detectors are reverse-biased and cannot be turned on. When line push-to-talk occurs, switched A+ is applied to pin 10 forward biasing the Line Control Priority Gate transistors Q5 and Q6. The output from Q6 is applied to the F1 Bistable Multivibrator Q3 and Q4. The Bias Switch, Q7 sets the operating bias on the F1 Detector, Q2, and the PL Disable Detector Q8, and all other function detectors connected in other modules for about 375 milliseconds during line push-to-talk. Normally, the detectors are back-biased and cannot be turned on. A function tone entering on pin 14 passes through the Function Tone Amplifier, Q1, operating at about a +16 dBm clipping level, which assures adequate drive to the detector stages.

When a 1950 Hz tone is received, it passes through the L1 and C4 network and into the F1 detector stage, Q2. When the tone is detected and switched 8.8 volts (from push-to-talk function) is present, Q2 causes the F1 Bistable Multivibrator to change state, grounding the transmitter channel element via pin 3. Concurrently, the receiver is returned to its "Private-Line" mode when the transmitter

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PARTS LIST

TLN4038A "F1" Control Board PL-440-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; ±10%; 50 v; unl. stated
C1, 3, 11, 12, 23, 32	8D82905G07	0.1
C2, 5, 8, 10, 13, 14	21D82187B29	.001, 100 v
C4	8D84326A14	.0062 ±2%
C6	23D82783B08	1 ±20%; 35 v
C7	8D82905G02	.022
C9, 19, 26	8D82905G11	0.22
C15, 27	8D82905G25	.0033
C16, 18, 28, 30	8C82284C01	.001
C17, 29	8C84326A30	.0045 ±1%
C20, 21	23K865136	15 ±20%; 25 v
C22	23D82601A25	100+150-10%; 20 v
C24, 31	21D82187B27	.002; 100 v
C25	8D82905G03	.047
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 9	48C82392B03	silicon
		REACTOR:
L1, 2, 3	1V80702B11	(factory-adjusted); res 40 ohms ±10%; includes grounding clip
		TRANSISTOR: (SEE NOTE)
Q1, 2, 5, 7, 8, 9, 11, 12, 13, 14	48R869570	N-P-N; type M9570
Q3, 10	48R869571	P-N-P; type M9571
Q4	48R869567	N-P-N; type M9567
Q6	48R869491	N-P-N; type M9491
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R1	6S129620	560
R2, 12	6S129805	1K ±5%
R3	6S129299	68K ±5%
R4	6S129886	27K ±5%
R5	6S124A09	22 ±5%
R6	6S129667	22K ±5%
R7, 20	6S128689	2.2K
R8, 9	6S129804	2.2K ±5%
R10	6S131275	220 ±5%
R13, 16	6S6229	1K; 1/2 w
R14, 21, 24, 44	6S129225	10K
R15	6S127802	1K
R17	6S129226	100K
R18, 43	6S128688	2.7K
R19	6S129232	3.9K
R22, 25, 29, 49	6S127805	15K
R23, 26	6S129231	3.3K
R27, 28	6S127804	4.7K
R30, 50	6S131858	220K ±5%
R31, 33, 51, 53	6S129526	33K ±5%
R32, 52	6S129669	4.7K ±5%
R34	6S129433	5.6K
R35	6S128685	22K
R36	6S129145	82K
R37	6S127806	27K
R38	6S124A19	56 ±5%
R39	6S129779	560 ±5%
R40	6S129235	1.2K
R41	6S6326	100; 1/2 w
R42	6S127803	1.5K
R45	6S131858	270K ±5%
R46	6S124D12	390K ±5%
R47	6S129806	330 ±5%
R48	6S129668	10K ±5%
R54	6S128903	39K

TLN4039A "F1" Control Panel PL-439-O

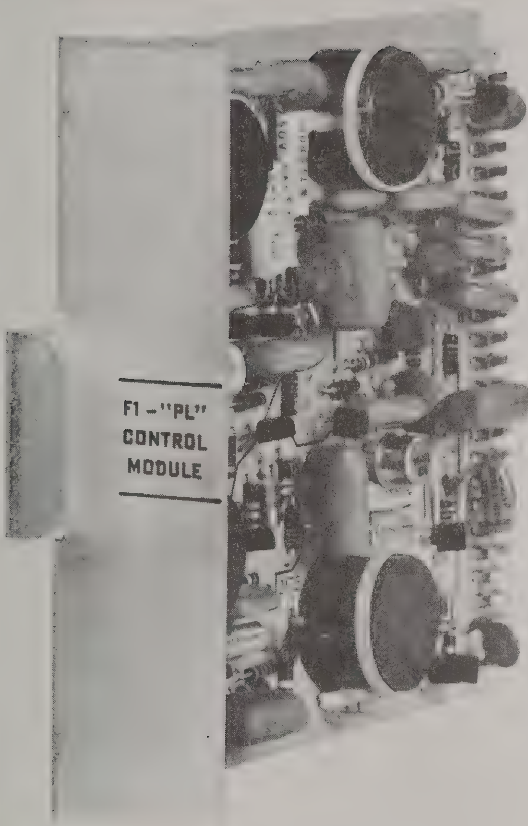
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
NON-REFERENCED ITEM		
	45B83914G01	GUIDE RAIL (slide-mount for circuit board): 2 req'd

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

F1-"PRIVATE-LINE" DISABLE CONTROL MODULE

MODEL TLN1244A



1. DESCRIPTION

The TLN1244A F1-"PL" Disable Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

The module converts the proper tone signal from a remote control source to a grounding function to turn on a transmitter channel element for frequency F1, or to disable the "Private-Line" operation of the receiver for channel monitoring before transmitting. The function is selected by the frequency of the received control tone.

3. CIRCUIT DESCRIPTION

In the quiescent state, all function detectors are reverse-biased and cannot be turned on. When line push-to-talk occurs, switched A+ is applied to pin 10 forward biasing the Line Control Priority Gate transistors Q5 and Q6. The output from Q6 is applied to the F1 Bistable Multivibrator Q3 and Q4. The Bias Switch, Q7 sets the operating bias on the F1 Detector, Q2, and the PL Disable Detector Q8, and all other function detectors connected in other modules for about 375 milliseconds during line push-to-talk. Normally, the detectors are back-biased and cannot be turned on. A function tone entering on pin 14 passes through the Function Tone Amplifier, Q1, operating at about a +16 dBm clipping level, which assures adequate drive to the detector stages.

When a 1950 Hz tone is received, it passes through the L1 and C4 network and into the F1 detector stage, Q2. When the tone is detected and switched 8.8 volts (from push-to-talk function) is present, Q2 causes the F1 Bistable Multivibrator to change state, grounding the transmitter channel element via pin 3. Concurrently, the receiver is returned to its "Private-Line" mode when the transmitter

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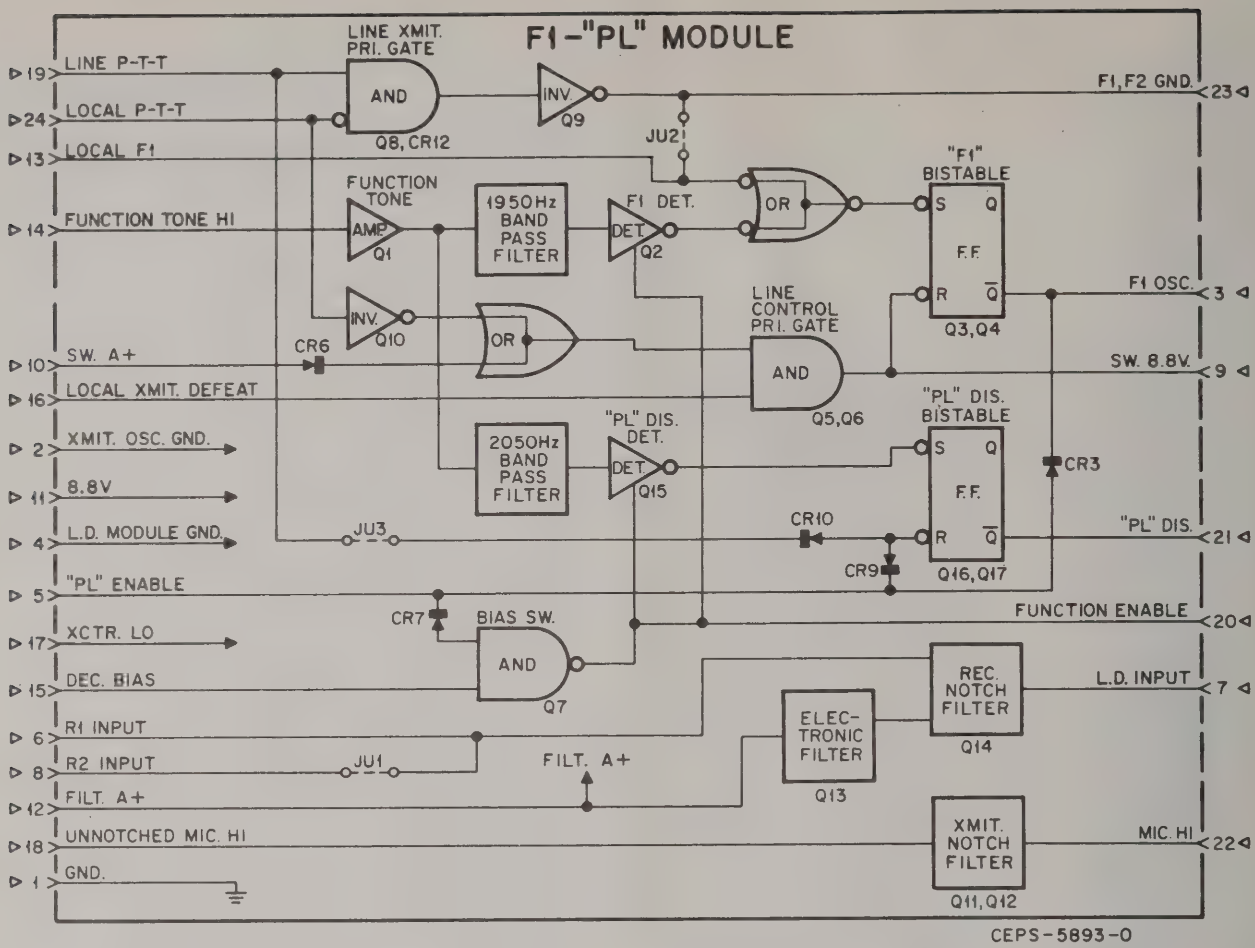


Functional Block Diagram

F1 frequency is keyed. This function is provided to permit the operator to monitor the channel before transmitting by disabling the "PL" function, but it automatically reverts to "PL" receive operation upon transmitting.

When a 2050 Hz tone is received, it is routed through Q1 as before, then to the "PL" disable detector, Q15 through the L4-C33 network. The detector triggers the "PL" Disable Bistable Multivibrator, Q16 and Q17, causing it to change state and apply a ground to pin 21. This ground is routed to the appropriate point to disable the receiver "Private-Line" circuit. In two frequency units, "PL" is re-enabled by F2 oscillator ground through pin 5 "PL" Enable. The receiver "PL" is automatically reset by Line Push-to-Talk (pin 19) if JU3 is installed.

Local transmission direct from the base station is controlled by applying a ground to the local P-T-T terminal, pin 24. This applies power to the F1 Bistable Multivibrator through transistors Q10, Q5, and Q6; and causes it to change state through the Line Transmit Priority Gate Q8 and Q9.

If while a local transmission is being made line push-to-talk occurs, the F1 Bistable Multivibrator is turned off by the sudden application of the line P-T-T and local transmit defeat, causing a momentary loss of switched 8.8 volts. After the line-controlled transmission is completed, the local transmission continues.

The receiver notch filter between the receiver input terminals, pins 6 & 8, and the line driver input, pin 7, prevents false guard tone decoder responses from receiver noise or speech signals by removing all the 2175 Hz components. The transmit notch filter, between pins 18 and 22, prevents the 2175 Hz guard tone from modulating a line-controlled transmission. Both notch filters have a notch depth greater than 45 dB at 2175 Hz. The electronic filter, Q13, and its associated components protect the receiver notch filter from any ripple appearing on the A+ line. A very low level audio is present at this stage and any ripple would be greatly amplified by the next stage into noise.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the

remote control chassis. To initially determine the location of the fault, operate the station locally, and initiate the desired function from the module. If the desired function occurs, then the module is functioning properly. If the function does not occur, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control in the station. To gain access to the module, remove the module, insert a Model TLN8799A PC Service Board, and reinsert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module:

PIN NUMBER	CONNECTION
1, 2, 4, 17	Ground
3	10K ohms to pin 11
10	to pin 12
11	1000 ohms to ground; 200 ohms to pin 12
12	A+ 13.6 volts dc
14	oscillator input
18	1000 ohms to ground; 1000 ohms to pin 12
20	to pin 1
21	10K ohms to pin 12
23	10K ohms to pin 11

c. Normal Conditions

The following chart tabulates normal levels and values for proper operation of the F1-"PL" Disable Control Module. Excessive deviation from these values indicates abnormal conditions.

Function	Typical Value
Overdrive level to F1 Detector @ 1950 Hz	9 dB
Overdrive level to "PL" Disable Detector @ 2050 Hz	9 dB
Switched 8.8 volt line	0 vdc (standby) 8 vdc (transmit)
F1 Tank Circuit Frequency	1950 Hz
"PL" Disable Tank Circuit Frequency	2050 Hz
F1 Pull-in Bandwidth (constant amplitude)	60 Hz
"PL" Disable Pull-in Bandwidth (constant amplitude)	60 Hz
Transmit Notch Frequency	2175 Hz
Receive Notch Frequency	2175 Hz
Transmit Notch Depth	Greater than 45 dB
Receive Notch Depth	Greater than 45 dB
Transmit Notch Insertion Loss @ 1 kHz (pin 18 to pin 22)	0 dB
Receive Notch Insertion Loss @ 1 kHz (pin 6 to pin 7)	2 dB

d. Stage Malfunction Location Techniques

(1) General

To locate a malfunction within the circuit module, a locally-injected signal may be applied to the input of a tone detector stage. If the tone causes the following bistable multivibrator to turn on, the preceding function tone amplifier stage should be investigated. If the bistable multivibrator does not turn on, the detector and multivibrator should be checked for proper voltages and operation.

(2) F1 Bistable Multivibrator

(a) Connect a dc voltmeter to the collector of Q4.

(b) Inject a 1950 Hz tone into tuned circuit L1 and C4 through a coupling capacitor, at a level not exceeding 1 volt.

(c) If the voltage at the collector changes to the value indicated on the schematic diagram for the operated condition, the bistable multivibrator is functioning. Check the function tone amplifier stage for a malfunction that prevents proper operation of the module.

(3) Function Tone Amplifier Stage

(a) Connect an audio oscillator to pin 14 (high) and pin 1 (ground). Set the oscillator to 1000 Hz at -10 dBm.

(b) Measure the output level at the collector of Q1. The level should be at least +10 dBm. As viewed on an oscilloscope, the waveform should be well into clipping condition.

(c) If the preceding conditions cannot be obtained, check voltages and components of the function tone amplifier stage.

(4) Transmit Notch Filter Stage

(a) Connect the biasing resistor network to pin 18 as indicated in the table.

(b) Connect an audio oscillator between pin 17 (low side) through a .1 uF capacitor to pin 18 (high side).

(c) Connect an ac voltmeter to pins 17 and 22 to measure output as audio is injected from the oscillator.

(d) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltage at each frequency.

(e) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the transmit notch filter stage.

(5) Receiver Notch Filter Stage

(a) Connect an audio oscillator across pin 6 (high side) and ground.

(b) Connect an ac voltmeter between pin 7 and pin 4.

(c) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltages at each frequency.

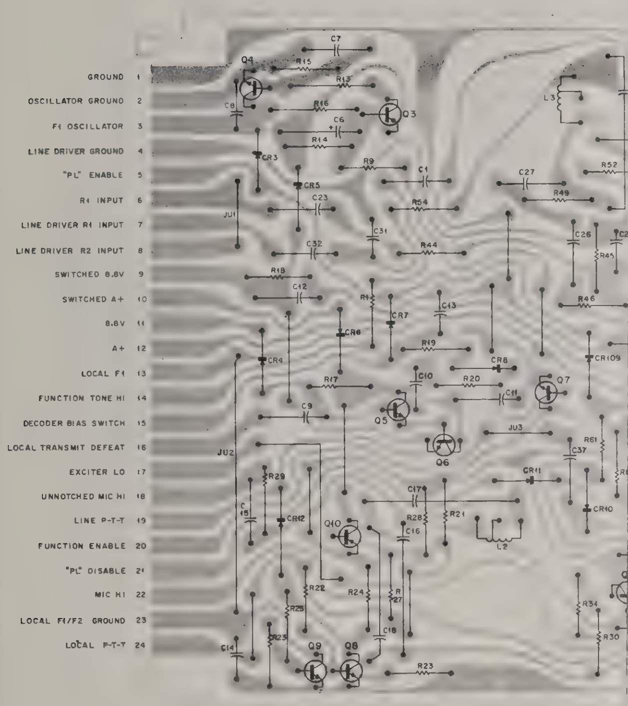
(e) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the receiver notch filter stage.

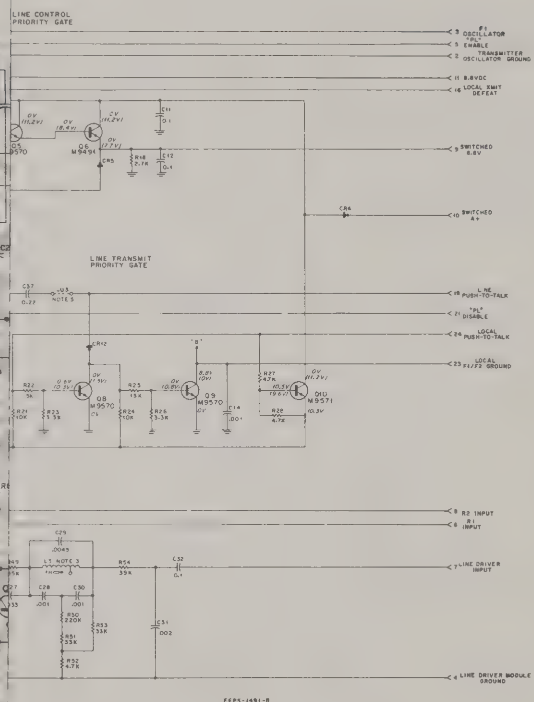
(6) "PL" Disable Bistable Multivibrator

(a) Connect a dc voltmeter to the collector of Q17.

(b) Inject a 2050 Hz tone into tuned circuit L4-C33 through a coupling capacitor, at a level not exceeding 1 volt.

(c) If the voltage at the collector changes to the value indicated on the schematic diagram for the operated condition, the bistable multivibrator is functioning. Check the function tone amplifier stage for a malfunction that prevents proper operation of the module.





F1-"PL" DISABLE CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

F1-"Private-Line" Disable Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81004E89-B
3/12/71-UP

(b) Inject a 1950 Hz tone into tuned circuit L1 and C4 through a coupling capacitor, at a level not exceeding 1 volt.

(c) If the voltage at the collector changes to the value indicated on the schematic diagram for the operated condition, the bistable multivibrator is functioning. Check the function tone amplifier stage for a malfunction that prevents proper operation of the module.

(3) Function Tone Amplifier Stage

(a) Connect an audio oscillator to pin 14 (high) and pin 1 (ground). Set the oscillator to 1000 Hz at -10 dBm.

(b) Measure the output level at the collector of Q1. The level should be at least +10 dBm. As viewed on an oscilloscope, the waveform should be well into clipping condition.

(c) If the preceding conditions cannot be obtained, check voltages and components of the function tone amplifier stage.

(4) Transmit Notch Filter Stage

(a) Connect the biasing resistor network to pin 18 as indicated in the table.

(b) Connect an audio oscillator between pin 17 (low side) through a .1 uF capacitor to pin 18 (high side).

(c) Connect an ac voltmeter to pins 17 and 22 to measure output as audio is injected from the oscillator.

(d) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltage at each frequency.

(e) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the transmit notch filter stage.

(5) Receiver Notch Filter Stage

(a) Connect an audio oscillator across pin 6 (high side) and ground.

(b) Connect an ac voltmeter between pin 7 and pin 4.

(c) Inject audio tones at a -20 dBm level at 1000, 1500, 2000, 2100, 2175, 2200, 2300, 2400, and 2500 Hz and measure the output voltages at each frequency.

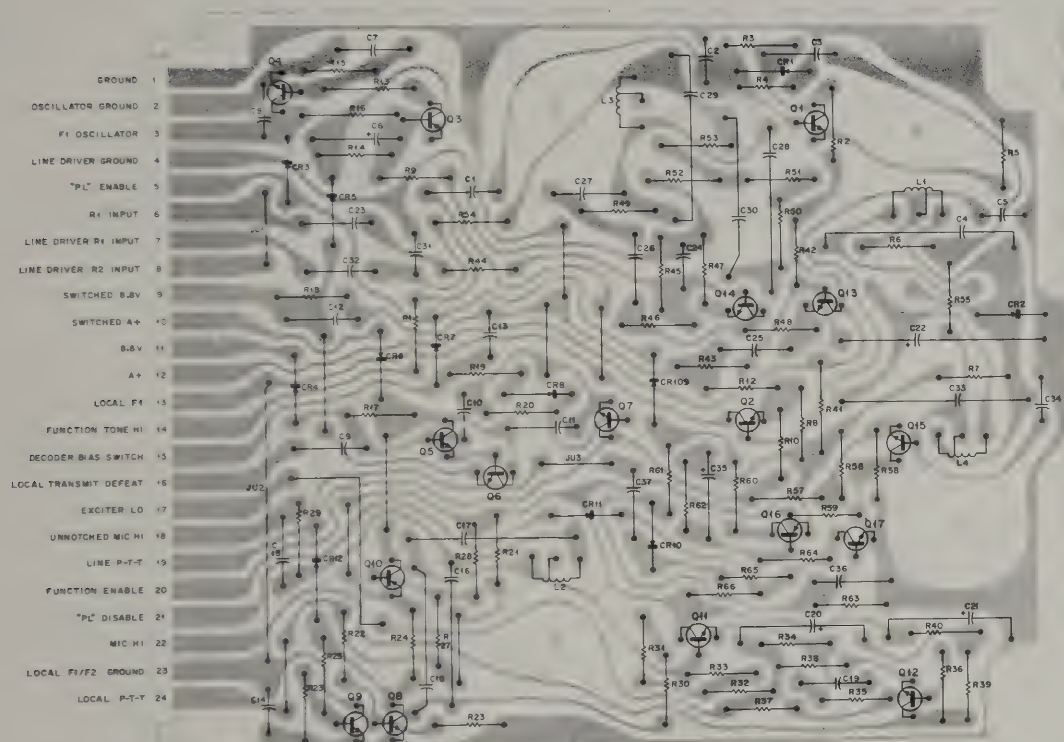
(e) Minimum output should be measured at 2175 Hz, indicating the notch in the filter response. If the notch is not apparent, check voltages and components in the receiver notch filter stage.

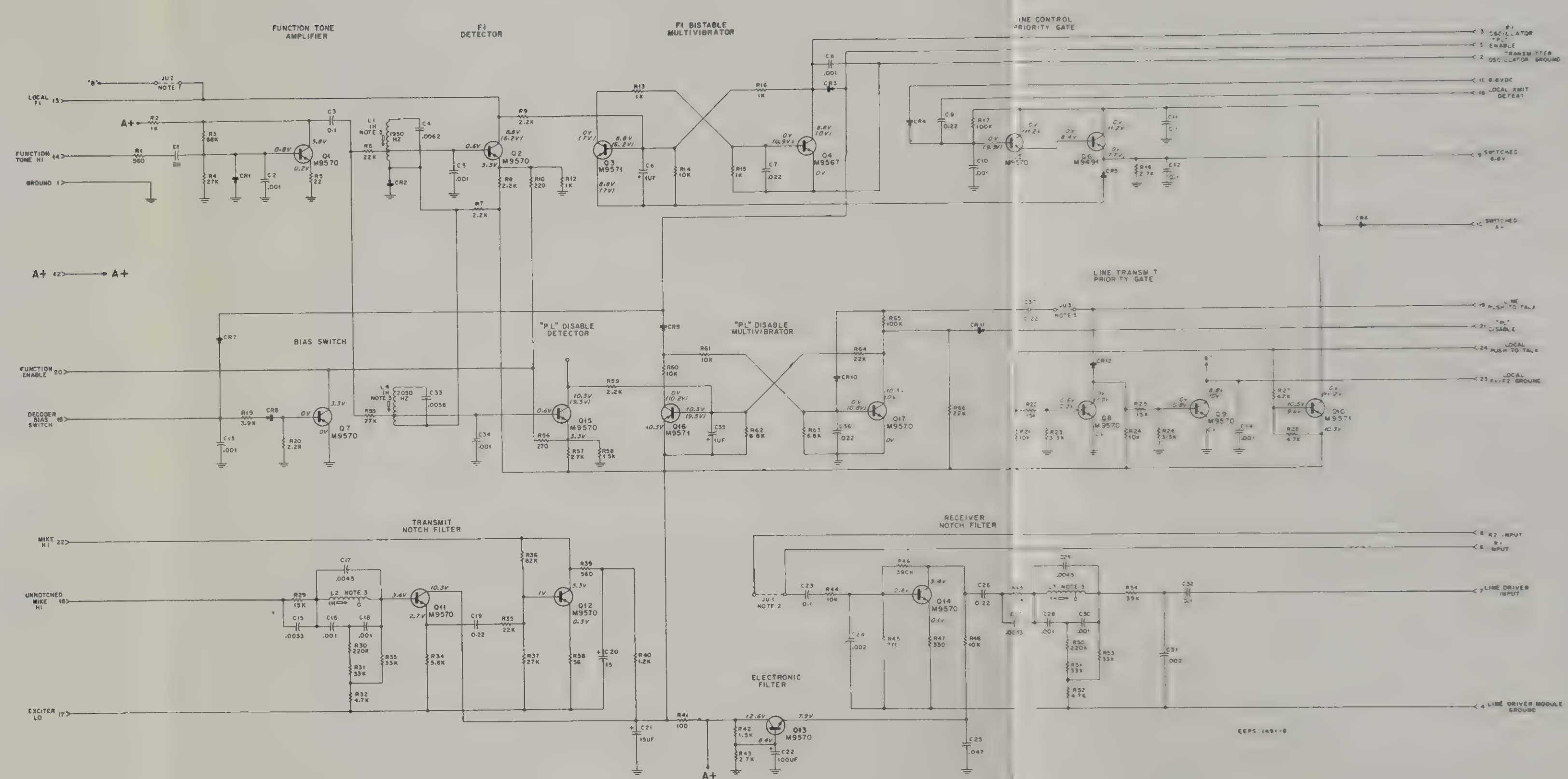
(6) "PL" Disable Bistable Multivibrator

(a) Connect a dc voltmeter to the collector of Q17.

(b) Inject a 2050 Hz tone into tuned circuit L4-C33 through a coupling capacitor, at a level not exceeding 1 volt.

(c) If the voltage at the collector changes to the value indicated on the schematic diagram for the operated condition, the bistable multivibrator is functioning. Check the function tone amplifier stage for a malfunction that prevents proper operation of the module.





NOTES:

1. JU2 REMOVED WHEN 2-FREQUENCY TRANSMITTERS ARE USED.
2. JU1 REMOVED EXCEPT ON 2-RECEIVER STATIONS WITHOUT 4-WIRE AUDIO, OR 2-RECEIVER STATIONS WITH SEPARATE TRANSMITTER AND RECEIVER AUDIO LINES.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.
4. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED CONDITION.
5. ADD JU3 FOR AUTOMATIC RECEIVER "PL" ENABLE BY LINE PUSH-TO-TALK.

EPS-2105-B

F1-"PL" DISABLE CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

F1-"Private-Line" Disable Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81004E89-B
3/12/71-UP

RENCE IBOL	MOTOROLA PART NO.	DESCRIPTION

1A "F1-PL" Control Panel PL-441-O

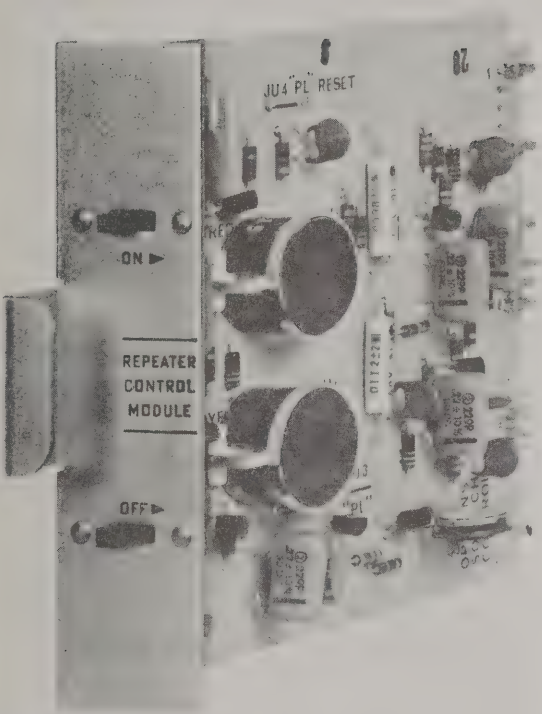
	NON-REFERENCED ITEM	
	45B83914G01	GUIDE RAIL (slide-mount for circuit board): 2 req'd

:

eplacement diodes and transistors must be ordered by
otorola part number only for optimum performance.

F2 CONTROL MODULE

MODEL TLN1246A



1. DESCRIPTION

This is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

The module contains line level and squelch controls for a second receiver and circuitry for selection of the F2 transmit frequency. Frequency selection is performed with a 1850-Hz tone input from a remote source.

2. OPERATION

a. Line Operation

Normally, the F2 Control Module is activated by tone signals supplied over the wire control line from the remote control point to the base station. Signals are routed through the base station to the remote control chassis in which the control module is mounted, and into the module.

b. Local Operation

For local test purposes, functions of the module may be activated from the front panel of the module. To locally select the F2 frequency, move the F1-F2 slide switch to the F2 position. This will cause the F2 bistable multivibrator to change state and energize the F2 channel element. After the local transmission is made, the switched 8.8-volt supply to the bistable multivibrator is cut off, causing the bistable multivibrator to revert to its original state and shut off the F2 channel element.

IMPORTANT

DO NOT OPERATE F1-F2 SWITCH WHEN TRANSMITTER IS KEYED.

3. CIRCUIT DESCRIPTION

When a ground is applied to the function enable line, pin 13, and switched 8.8 volts is available at pin 8, the detector stage Q1, is operational. When operational, the detector will accept a signal from the amplifier stage, Q4.

A function tone entering the module on pin 11 passes to the amplifier stage, Q4, where it is

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REVISIONS

63P81004E89-B

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4040A	R56	WAS 6S129804, 2.2K	Q15 EMITTER
	R57	WAS 6S131275, 220	
	R58	WAS 6S129805, 1K	
TLN4040A-1			

PARTS LIST

TLN4040A "F1-PL" Control Board PL-442-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF; ±10%; 50 v; unl. stated
C1, 3, 11, 12, 23, 32	8D82905G07	0.1
C2, 5, 8, 10, 13, 14, 34	21D82187B29	.001; 100 v
C4	8D84326A14	.0062 ±2%
C6, 35	23D82783B08	1 ±20%; 35 v
C7, 36	8D82905G02	.022
C9, 19, 26, 37	8D82905G11	0.22
C15, 27	8D82905G25	.0033
C16, 18, 28, 30	8C82284C01	.001
C17, 29	8C84326A30	.0045 ±1%
C20, 21	23K865136	15 ±20%; 25 v
C22	23D82601A25	100 +150-10%; 20 v
C24, 31	21D82187B27	.002; 100 v
C25	8D82905G03	.047
C33	8D84326A13	.0056 ±2%
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 12	48C82392B03	silicon
		REACTOR:
L1, 2, 3, 4	1V80702B11	(factory-adjusted); res 40 ohms ±10%; includes grounding clip
		TRANSISTOR: (SEE NOTE)
Q1, 2, 5, 7, 8, 9, 11, 12, 13, 14	48R869570	N-P-N; type M9570
Q3, 10	48R869571	P-N-P; type M9571
Q4	48R869567	N-P-N; type M9567
Q6	48R869491	N-P-N; type M9491
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R1	6S129620	560
R2, 12	6S129805	1K ±5%
R3	6S129299	68K ±5%
R4, 55	6S129886	27K ±5%
R5	6S124A09	22 ±5%
R6	6S129667	22K ±5%
R7, 20	6S128689	2.2K
R8, 9, 59	6S129804	2.2K ±5%
R10	6S131275	220 ±5%
R13, 16	6S6229	1K; 1/2 w
R14, 21, 24, 44, 60, 61	6S129225	10K
R15	6S127802	1K
R17, 65	6S129226	100K
R18, 43	6S128688	2.7K
R19	6S129232	3.9K
R22, 25, 29, 49	6S127805	15K
R23, 26	6S129231	3.3K
R27, 28	6S127804	4.7K
R30, 50	6S131858	220K ±5%
R31, 33, 51, 53	6S129526	33K ±5%
R32, 52	6S129669	4.7K ±5%
R34	6S129433	5.6K
R35	6S128685	22K
R36	6S129145	82K
R37	6S127806	27K
R38	6S124A19	56 ±5%
R39	6S129779	560 ±5%
R40	6S129235	1.2K
R41	6S6326	100; 1/2 w
R42	6S127803	1.5K
R45	6S131858	270K ±5%
R46	6S124D12	390K ±5%
R47	6S129806	330 ±5%
R48	6S129668	10K ±5%
R54	6S128903	39K
R56	6S131525	270 ±5%
R57	6S129707	2.7K ±5%
R58	6S129681	1.5K ±5%
R62, 63	6S128687	6.8K

TLN4041A "F1-PL" Control Panel PL-441-O

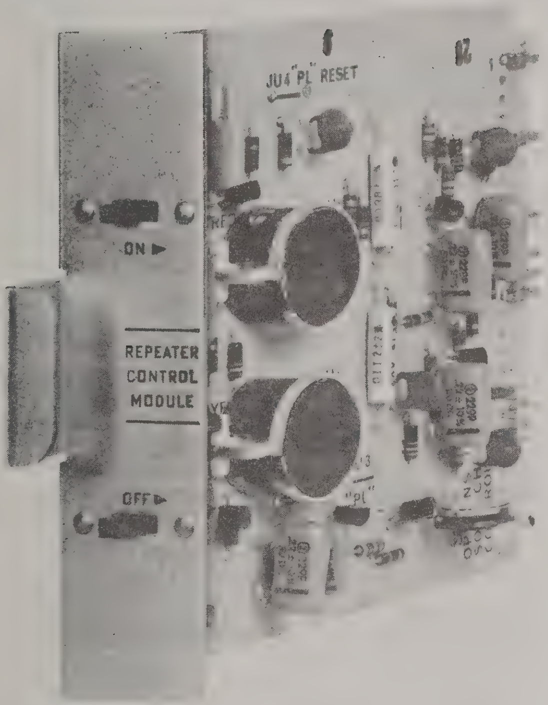
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
NON-REFERENCED ITEM		
	45B83914G01	GUIDE RAIL (slide-mount for circuit board): 2 req'd

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

F2 CONTROL MODULE

MODEL TLN1246A



1. DESCRIPTION

This is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

The module contains line level and squelch controls for a second receiver and circuitry for selection of the F2 transmit frequency. Frequency selection is performed with a 1850-Hz tone input from a remote source.

2. OPERATION

a. Line Operation

Normally, the F2 Control Module is activated by tone signals supplied over the wire control line from the remote control point to the base station. Signals are routed through the base station to the remote control chassis in which the control module is mounted, and into the module.

b. Local Operation

For local test purposes, functions of the module may be activated from the front panel of the module. To locally select the F2 frequency, move the F1-F2 slide switch to the F2 position. This will cause the F2 bistable multivibrator to change state and energize the F2 channel element. After the local transmission is made, the switched 8.8-volt supply to the bistable multivibrator is cut off, causing the bistable multivibrator to revert to its original state and shut off the F2 channel element.

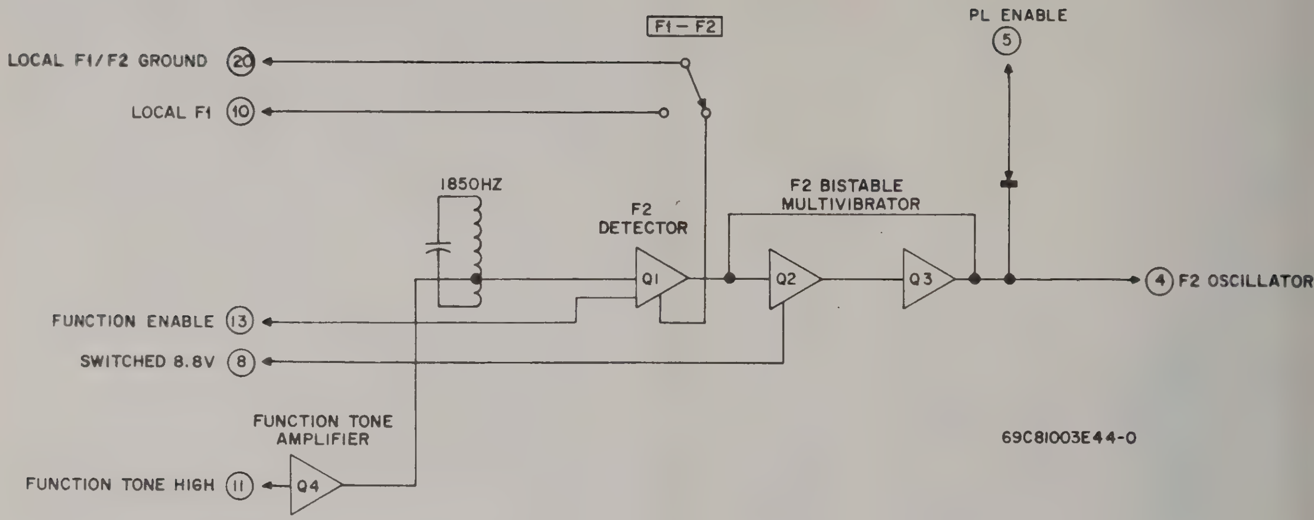
IMPORTANT

DO NOT OPERATE F1-F2 SWITCH WHEN TRANSMITTER IS KEYED.

3. CIRCUIT DESCRIPTION

When a ground is applied to the function enable line, pin 13, and switched 8.8 volts is available at pin 8, the detector stage Q1, is operational. When operational, the detector will accept a signal from the amplifier stage, Q4.

A function tone entering the module on pin 11 passes to the amplifier stage, Q4, where it is



Functional Block Diagram

amplified and clipped to a +16 dBm level. This level assures adequate drive to the succeeding detector stage. From the amplifier stage, the tone enters the tuned circuit, L1 and C1, which will pass only a 1850-Hz tone into Q1. When the tone is detected in transistor Q1, it causes the bistable multivibrator to change state and apply a ground to the F2 channel element via pin 4. This turns on the channel element for the F2 frequency for the duration of the transmission.

At the end of the transmission, the switched 8.8 volts is removed, the bistable multivibrator reverts to its initial condition, and the F2 channel element is turned off.

Controls for the station second receiver are included on the circuit board. Potentiometer R18 adjusts the line level output from the receiver, while potentiometer R16 sets the squelch threshold level for the second receiver.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To initially determine the location of the fault, operate the station locally and initiate the desired function from the module. If the desired function occurs, the module is functioning properly. If the function does not occur, the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access, remove the module, insert a Model TLN8799A Module Extension Board and reinsert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module:

PIN NUMBER	CONNECTION
1, 2, 13	Ground
4	10 kilohms to pin 12
5	10 kilohms to pin 12
8	to pin 12
11	oscillator input
12	A+; 13.6 volts dc

c. Normal Conditions

The following chart tabulates normal levels and values for proper operation of the F2 control module. Excessive deviation from these values indicates abnormal conditions in the module.

FUNCTION	TYPICAL VALUE
F2 Tank Circuit Frequency	1850 Hz
F2 Pull-in Bandwidth (constant amplitude)	60 Hz
F2 Detector Overdrive @ 1850 Hz	9 dB

d. Module Malfunction Location Techniques

(1) F2 Bistable Multivibrator

(a) Connect a dc voltmeter across pin 4 and pin 2.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q1. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1850 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage, Q1, then the bistable multivibrator, Q2 and Q3. If the change of state occurs, look to the function tone amplifier for a malfunction.

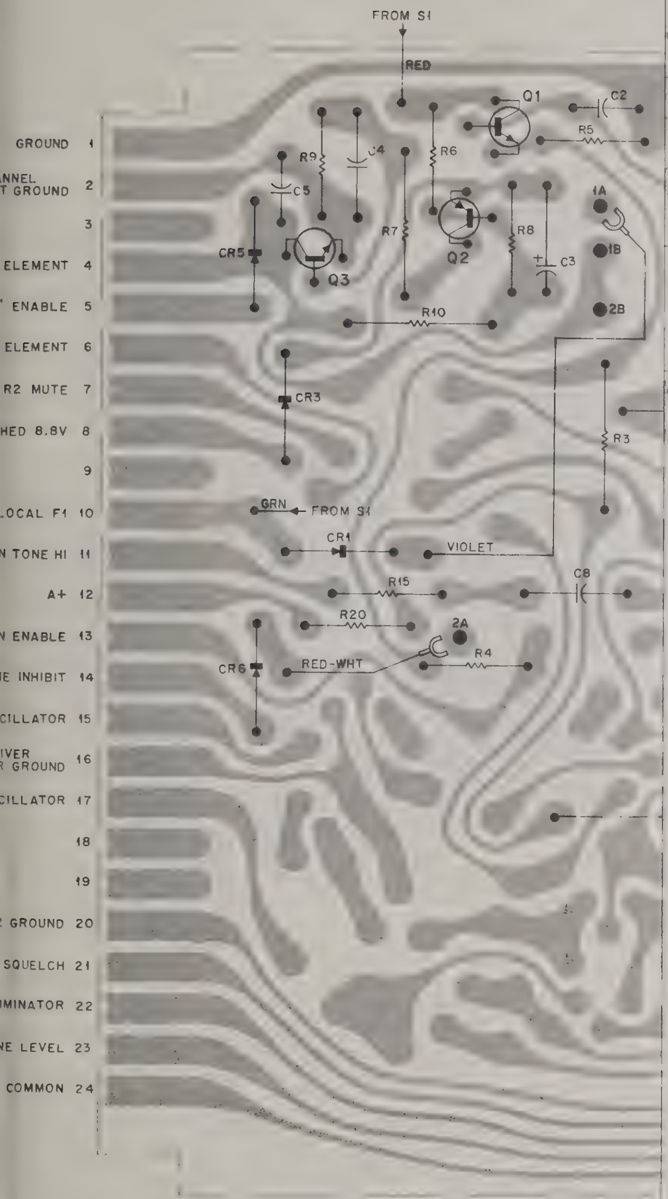
(2) Function Tone Amplifier Stage

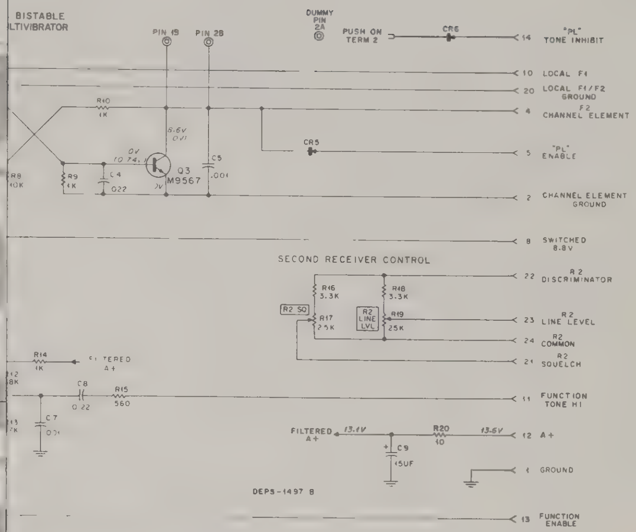
(a) Connect an ac voltmeter from the capacitor connected to the collector of Q4 to ground.

(b) Connect an audio oscillator from pin 11 to ground. Adjust the oscillator output to -10 dBm at 1800 Hz.

(c) The measured output should be at least +10 dBm. When viewed with an oscilliscope, the waveform should be well into a clipped condition.

(d) If the previous conditions are not attained, measure the voltages on the function tone detector stage.

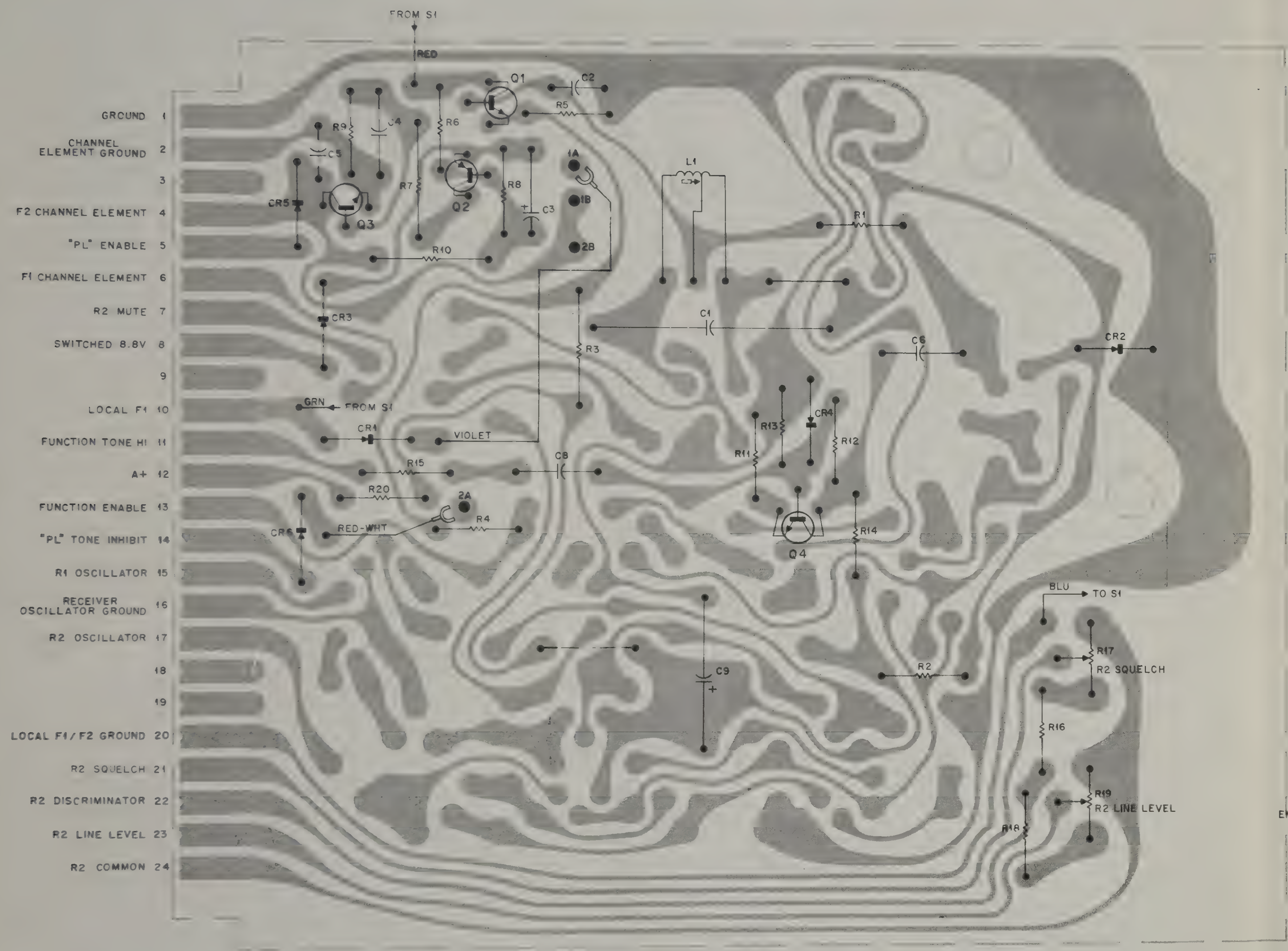




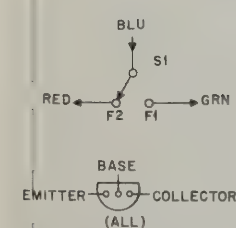
F2 CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

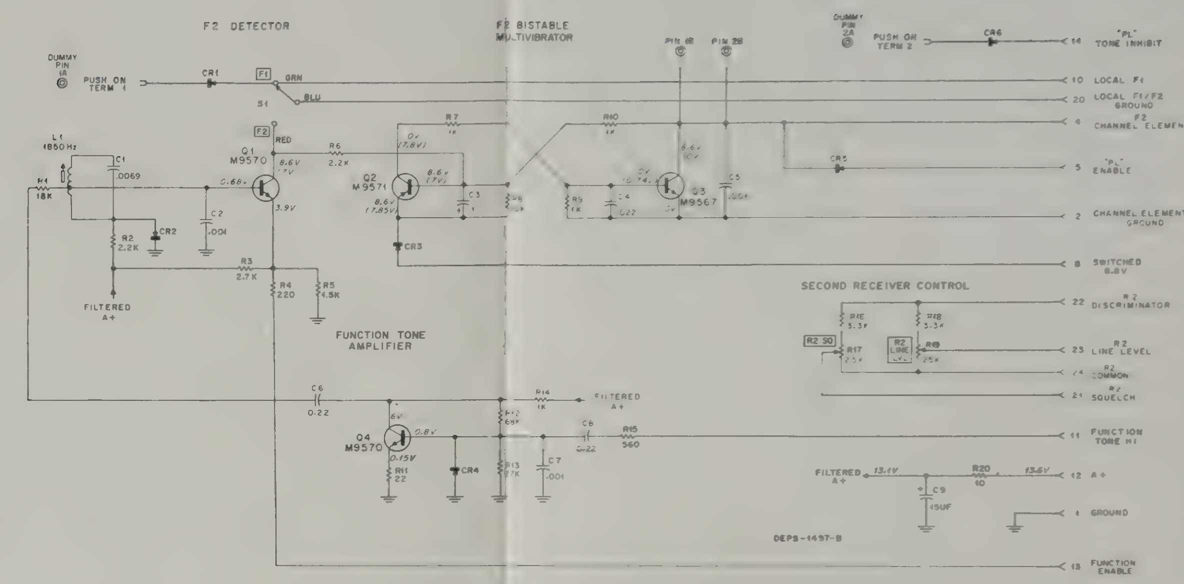
F2 Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81004E94-B
3/1/72-UP



OL-DEPS-1496-B
BD-DEPS-1495 A



TRANSISTOR DETAIL



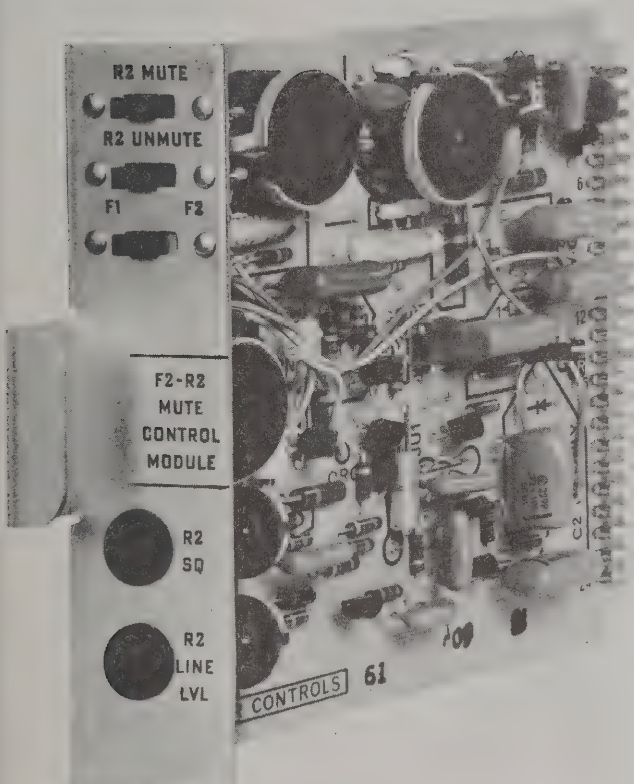
F2 CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

F2 Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81004E94-B
3/1/72-UP

F2-R2 MUTE CONTROL MODULE

MODEL TLN1247A



1. DESCRIPTION

The TLN1247A F2-R2 Mute Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module contains line level and squelch controls for a second receiver. It also contains circuitry for selection of the F2 transmit frequency and muting or unmuting of the second receiver. Frequency selection and receiver muting and unmuting are performed with tone inputs of the proper frequencies from a remote source. The F2 frequency selection is accomplished with an 1850-Hz tone; the R2 mute function requires a 1750-Hz tone; and the R2 unmute function is performed with a 1650-Hz tone.

3. CIRCUIT DESCRIPTION

When a ground is applied to the function enable line, pin 13, all detector stages, Q1, Q5, and Q8 are operational. For the F2 detector, switched 8.8 volts must also be present at pin 8. While the detectors are energized, the function tone, amplified and clipped in the Q4 stage, passes on to the appropriate detector stage.

When an 1850-Hz tone leaces tone amplifier stage Q4 and passes through tuned circuit L1-C1, it enters F2 detector stage Q1. Detection causes the F2 bistable multivibrator, Q2 and Q3, to change state and apply a ground to the F2 channel element via pin 4.

A 1750-Hz tone passing through amplifier stage Q4 is amplified and clipped to a +16 dBm level. This tone will pass through the L2-C10 tuned circuit and be detected in R2 mute detector

REVISIONS

63P81004E94-B

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4044A	C3	WAS 8D82905G02, .022 uF	Q2 BASE
	R1	WAS 6S129667, 22K	L1 TAP
	R3	WAS 6S2028, 2.2K	Q1 EMITTER
	R5	WAS 6S129805, 1K	
TLN4044A-1			

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN4044A Decoder Board PL-483-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 v; unl. stated
C1	8D84326A15	.0069 ±2%
C2	21D82187B29	.001; 100 v
C3	23D82783B08	1 ±20%; 35 v
C4	8D82905G02	.022
C5	21D82187B29	.001; 100 v
C6	8D82905G11	0.22
C7	21D82187B29	.001; 100 v
C8	8D82095G11	0.22
C9	23K865136	15 ±20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 6	48C82392B03	silicon
		COIL ASSEMBLY, inductor:
L1	1V80702B11	1H; incl. ground clip
		TRANSISTOR: (SEE NOTE)
Q1	48R869570	N-P-N; M9570
Q2	48R869571	P-N-P; M9571
Q3	48R869567	N-P-N; M9567
Q4	48R869570	N-P-N; M9570
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R1	6S131526	18K ±5%
R2	6S128689	2.2K
R3	6S5652	2.7K ±5%; 1/2 w
R4	6S131275	220 ±5%
R5	6S129681	1.5K ±5%
R6	6S128689	2.2K
R7	6S6229	1K; 1/2 w
R8	6S129225	10K
R9	6S127802	1K
R10	6S6229	1K; 1/2 w
R11	6S124A08	22 ±5%
R12	6S129299	68K ±5%
R13	6S129886	27K ±5%
R14	6S129805	1K ±5%
R15	6S129620	560
R16	6S129231	3.3K
R17	18C83083G03	variable; 25K
R18	6S129231	3.3K
R19	18C83083G03	variable; 25K
R20	6S129755	10
	NON-REFERENCED ITEM	
	42S10217A01	STRAP, cable harness

TLN4045A F2 Decoder Panel Kit PL-496-O

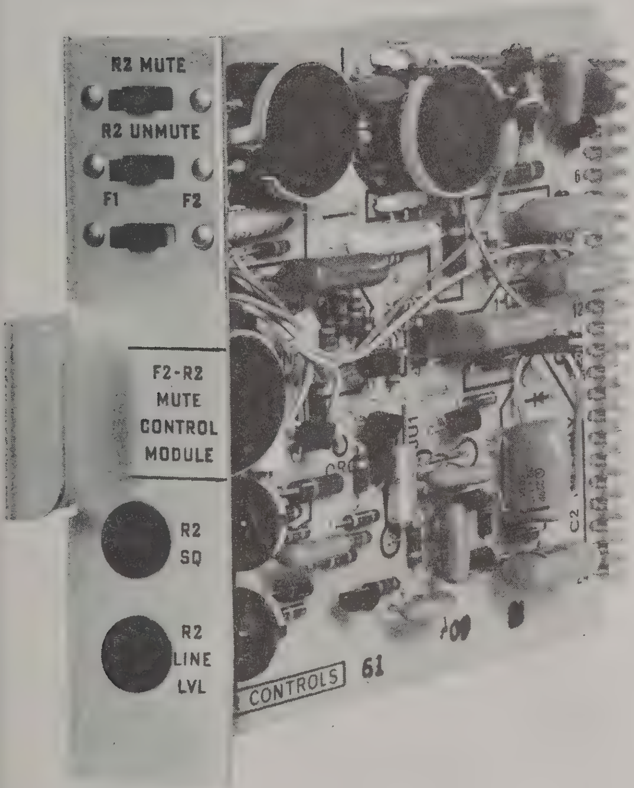
		SWITCH, slide:
S1	40B83204B01	dpdt
	NON-REFERENCED ITEMS	
	1V80702B17	PANEL ASSY. (riveted); incl. ref. part S1
	45B83914G01	GUIDE, card: 2 used

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

F2-R2 MUTE CONTROL MODULE

MODEL TLN1247A



1. DESCRIPTION

The TLN1247A F2-R2 Mute Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module contains line level and squelch controls for a second receiver. It also contains circuitry for selection of the F2 transmit frequency and muting or unmuting of the second receiver. Frequency selection and receiver muting and unmuting are performed with tone inputs of the proper frequencies from a remote source. The F2 frequency selection is accomplished with an 1850-Hz tone; the R2 mute function requires a 1750-Hz tone; and the R2 unmute function is performed with a 1650-Hz tone.

3. CIRCUIT DESCRIPTION

When a ground is applied to the function enable line, pin 13, all detector stages, Q1, Q5, and Q8 are operational. For the F2 detector, switched 8.8 volts must also be present at pin 8. While the detectors are energized, the function tone, amplified and clipped in the Q4 stage, passes on to the appropriate detector stage.

When an 1850-Hz tone leaces tone amplifier stage Q4 and passes through tuned circuit L1-C1, it enters F2 detector stage Q1. Detection causes the F2 bistable multivibrator, Q2 and Q3, to change state and apply a ground to the F2 channel element via pin 4.

A 1750-Hz tone passing through amplifier stage Q4 is amplified and clipped to a +16 dBm level. This tone will pass through the L2-C10 tuned circuit and be detected in R2 mute detector

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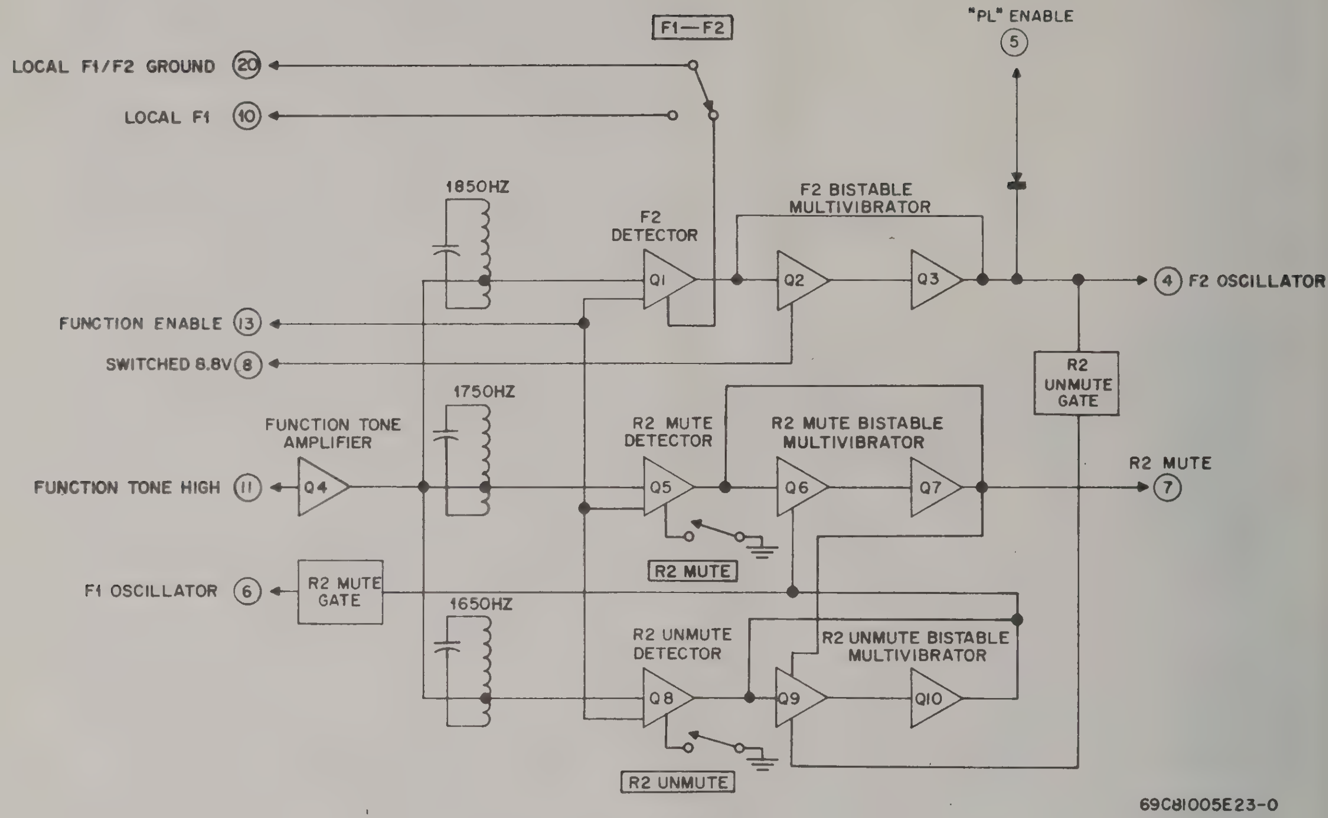


Functional Block Diagram

stage Q5, causing the R2 mute bistable multivibrator, A6 and Q7, to change state. This change of state causes a ground to be applied through resistor R31 and diode CR10 to pin 7 for muting receiver R2. Concurrently, the ground also blocks drive to transistor Q10 in the R2 Unmute bistable multivibrator through diode CR9, turning off the unmute bistable multivibrator.

A 1650 Hz tone passing through the amplifier stage Q4 is amplified and clipped as previously described. This tone passes through the L3-C16 tuned circuit into R2 unmute detector stage Q8. Detection here causes the R2 unmute bistable multivibrator Q9 and Q10 to trigger to its on state, blocking the drive to transistor Q7 in the R2 mute bistable multivibrator. In this condition, the mute bistable cuts off, removing the ground from the receiver, which unmutes it.

Controls for the station second receiver are included on the circuit board. Potentiometer R19 adjusts the line level output from the receiver, and potentiometer R17 sets the squelch threshold level for the second receiver.

The second receiver may also be muted or unmuted by operating the appropriate switch on the front panel. The panel switches directly operate the proper bistable multivibrator.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To initially determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired operation occurs, the module is functioning properly. If it does not occur the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station.

To gain access to the module, remove it, insert a Model TLN8799A Module Extension Board, and reinsert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done after proper power and terminations are connected to the module:

PIN NUMBER	CONNECTION
1, 2, 13	Ground
4	10 kilohms to pin 12
5	10 kilohms to pin 12
7	100 kilohms to pin 12
8	to pin 12
11	oscillator input
12	A+; 13.6 volts dc

c. Normal Conditions

The following chart tabulates normal levels and values for proper operation of the F2-R2 Mute Control Module. Excessive deviations from these values indicates abnormal conditions in the module.

Function	Typical Value
F2 Tank Circuit Frequency	1850 Hz
R2 Mute Tank Circuit Frequency	1750 Hz
R2 Unmute Tank Circuit Frequency	1650 Hz
F2 Pull-in Bandwidth (constant amplitude)	60 Hz
R2 Mute Pull-in Bandwidth (constant amplitude)	60 Hz
R2 Unmute Pull-in Bandwidth (constant amplitude)	60 Hz
F2 Detector Overdrive @ 1850 Hz	9 dB
R2 Mute Detector Overdrive @ 1750 Hz	9 dB
R2 Unmute Detector Overdrive @ 1650 Hz	9 dB

d. Module Malfunction Location Techniques

(1) F2 Control Stages

(a) Connect a dc voltmeter across pin 4 and pin 2.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q1. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1850 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check detector stage Q1, then bistable multivibrator Q2 and Q3. If the change of state occurs, check the function tone amplifier for a malfunction.

(2) Function Tone Amplifier Stage

(a) Connect an ac voltmeter from the capacitor connected to the collector of Q4 to ground.

(b) Connect an audio oscillator from pin 11 to ground. Adjust the oscillator output to -10 dBm at 1800 Hz.

(c) The measured output should be at least +10 dBm. When viewed with an oscilloscope, the waveform should be well into a clipped condition.

(d) If the previous conditions are not attained, measure the voltages on the function tone detector stage.

(3) R2 Mute Stages

(a) Connect a dc voltmeter across the collector of transistor Q7 and ground (pin 1).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q5. The output level must not exceed 1 volt.

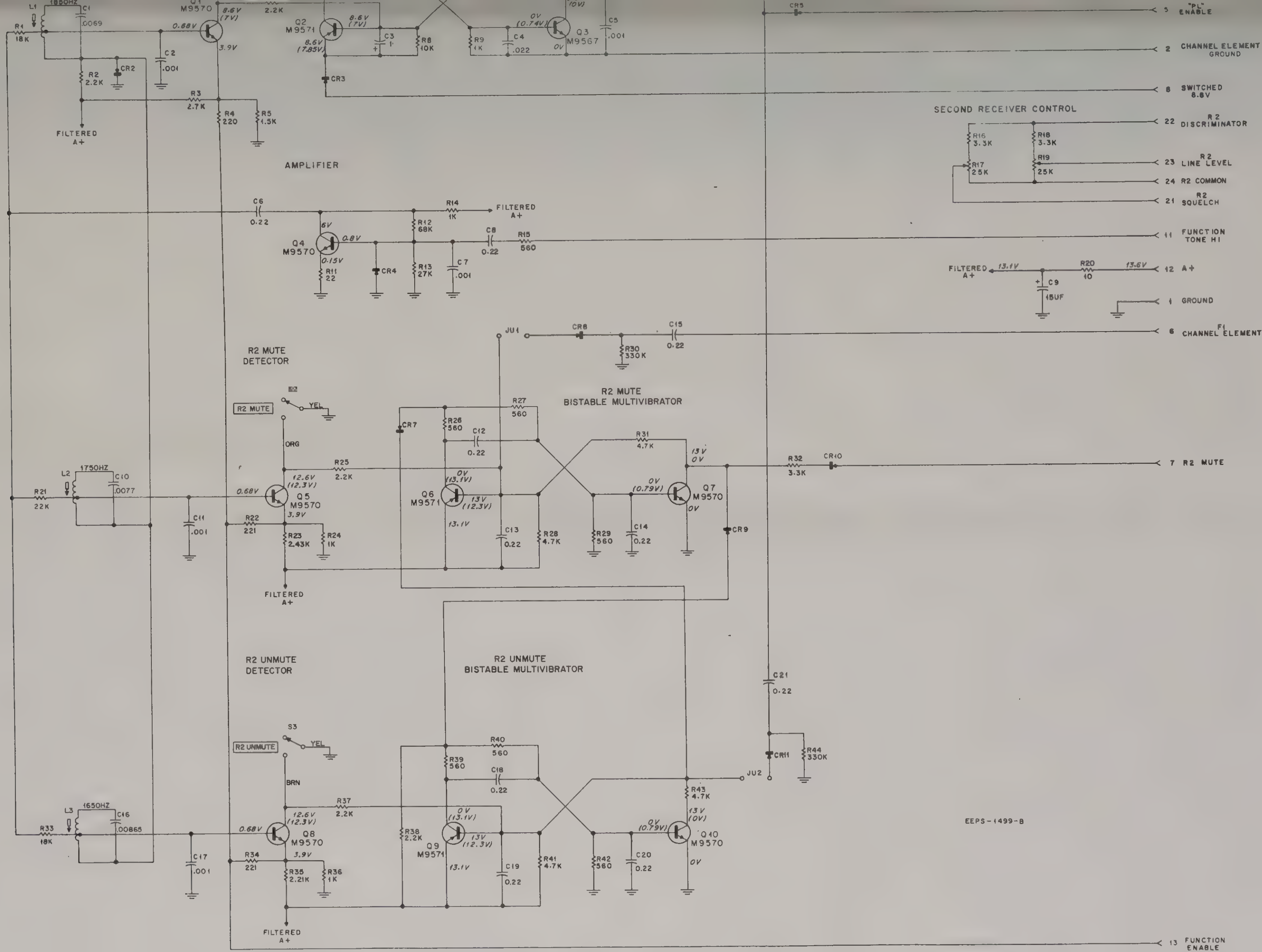
(c) Adjust the oscillator frequency to 1750 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check detector stage Q5, then bistable multivibrator Q6 and Q7. If the change of state occurs, look to the function tone amplifier for a malfunction.

(4) R2 Unmute Stages

(a) Connect a dc voltmeter across the collector of transistor Q10 and ground (pin 1).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of transistor Q8. The output level from the oscillator must not exceed 1 volt.

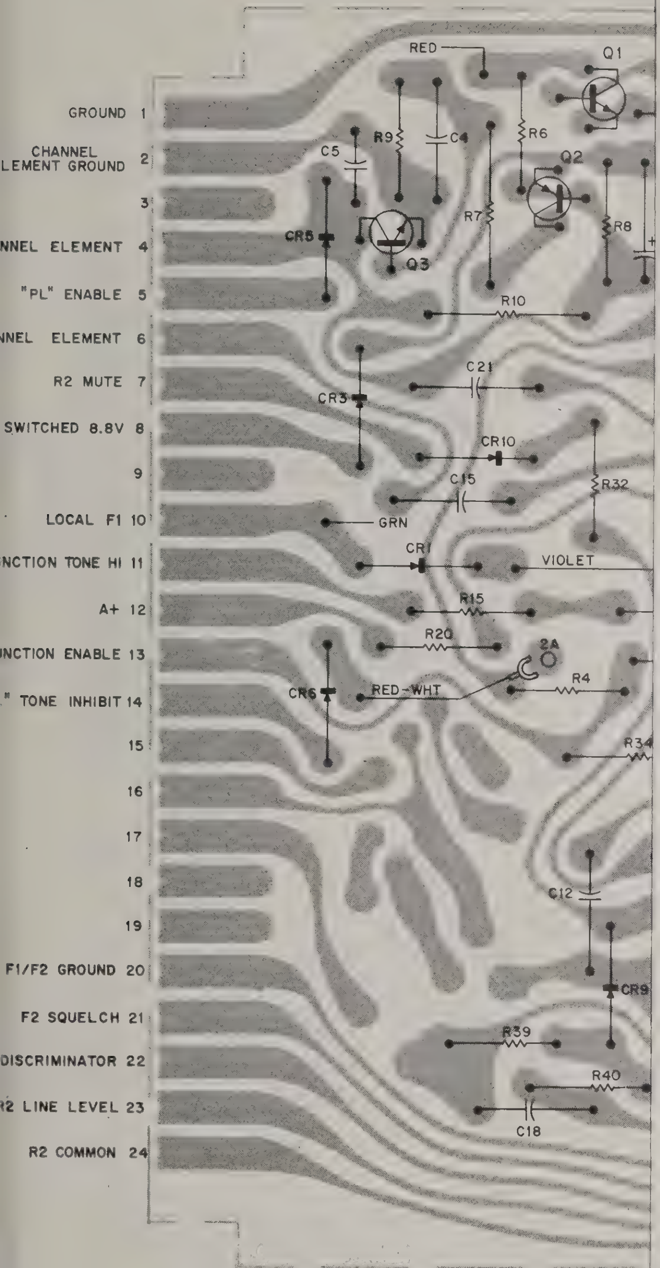
(c) Adjust the oscillator frequency to 1650 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the multivibrator does not change state, check detector stage Q8, then bistable multivibrator Q9 and Q10. If the change of state occurs, check the R2 Mute stages as previously described.



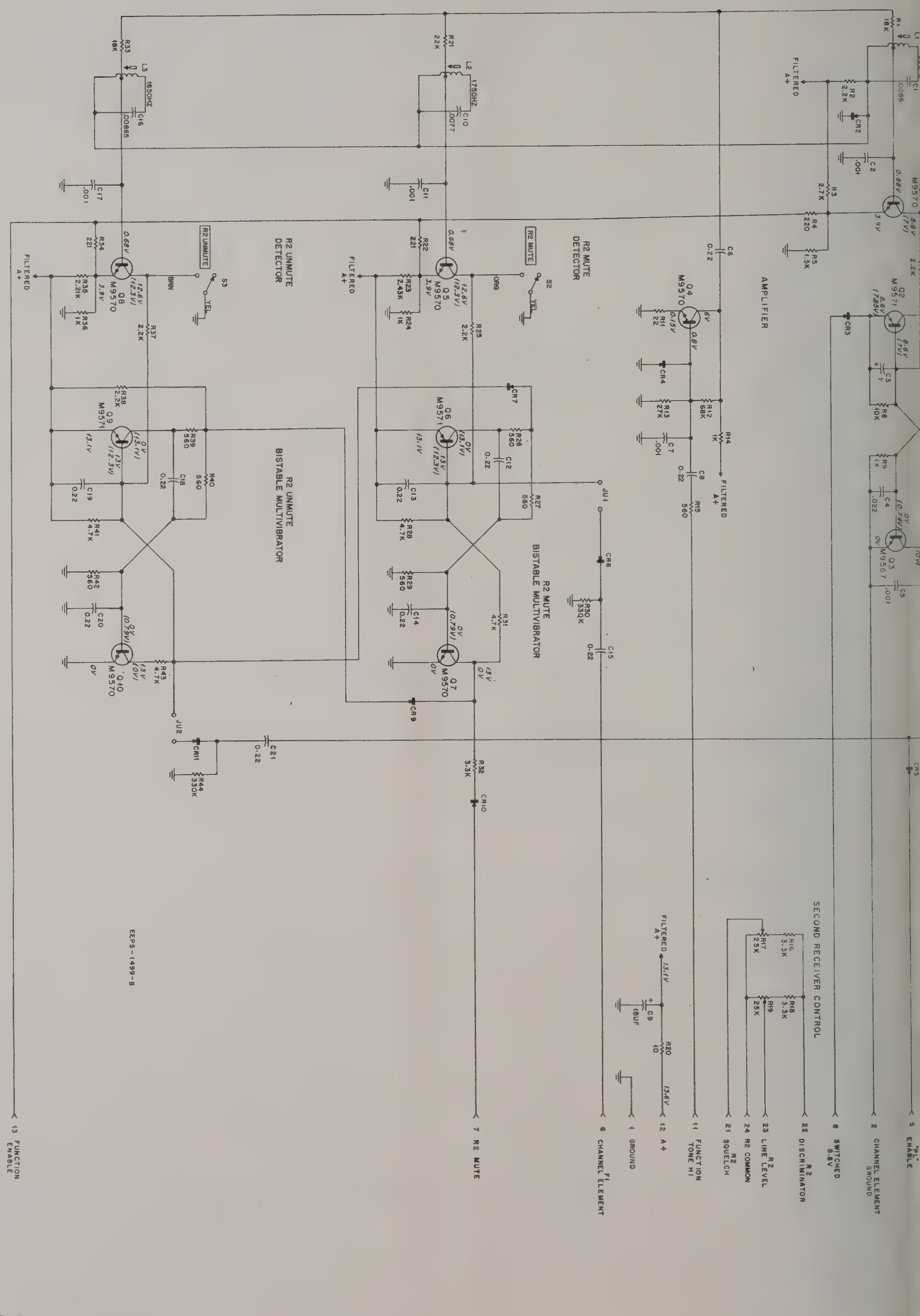
F2-R2 MUTE CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

F2-R2 Mute Control Module
Schematic Diagram And Circuit Board Detail
Motorola No. 63P81004E97-C
3/1/72-UP



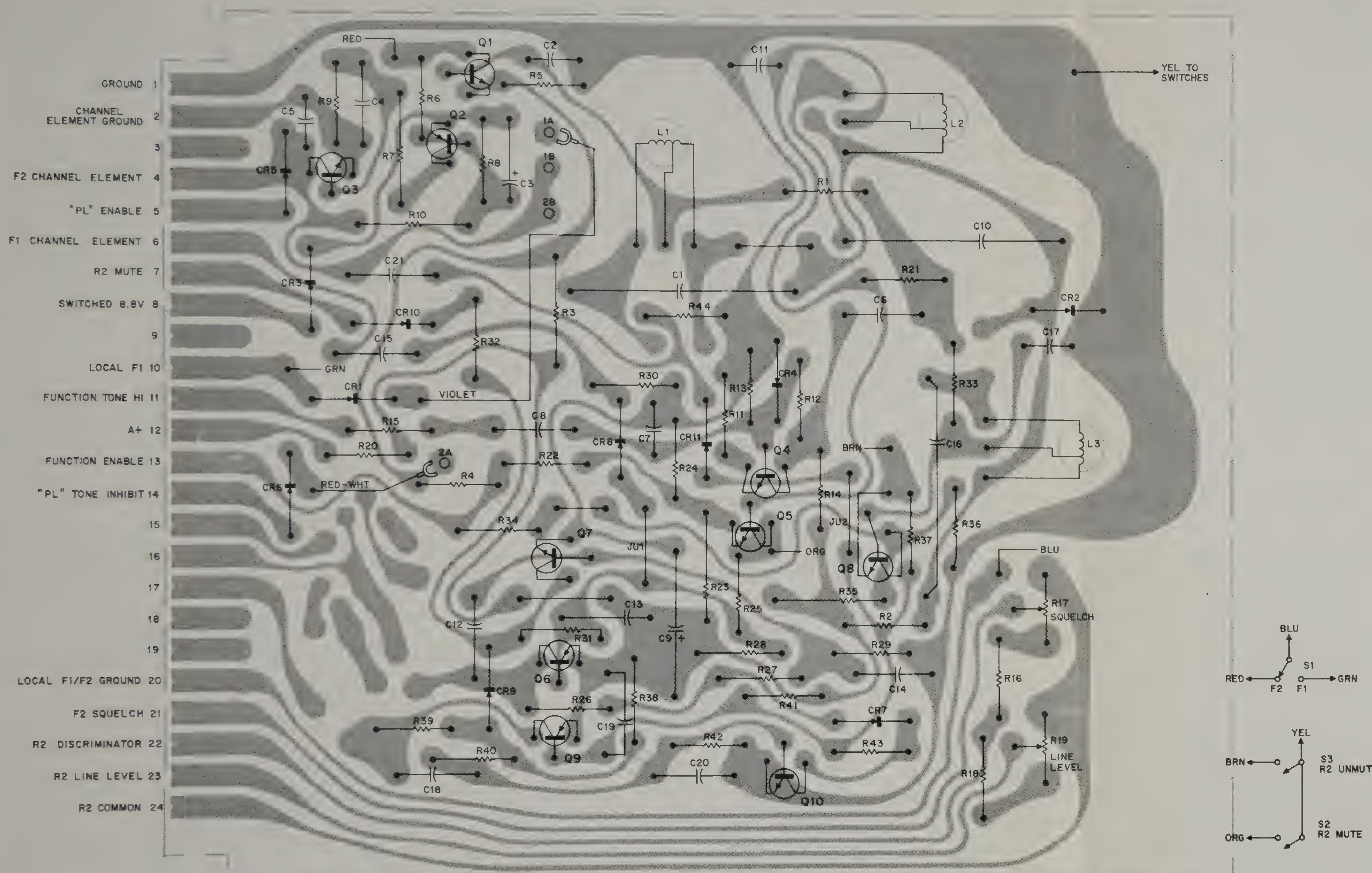
GROUND 1
CHANNEL ELEMENT GROUND 2
3
NNEL ELEMENT 4
"PL" ENABLE 5
NNEL ELEMENT 6
R2 MUTE 7
SWITCHED 8.8V 8
9
LOCAL F1 10
NCTION TONE HI 11
A+ 12
NCTION ENABLE 13
." TONE INHIBIT 14
15
16
17
18
19
F1/F2 GROUND 20
F2 SQUELCH 21
DISCRIMINATOR 22
2 LINE LEVEL 23
R2 COMMON 24
RED
Q1
R9
C4
R6
C5
Q2
R7
R8
CR5
Q3
R10
C21
CR3
CR10
R32
C15
GRN
CR1
VIOLET
R15
R20
2A
R4
CR6
RED-WHT
R34
C12
CR9
R39
R40
C18



PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

F2-R2 Mute Control Module
Schematic Diagram And Circuit Board Detail
Motorola No. 63P81004E97-C
3/1/72-UP

F2-R2 MUTE CONTROL MODULE



OL-DEPS-1498-A

BD-DEPS-1495-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R35	6D84444A08	2.21K ±1%
R36	6S129805	1K ±5%
R37	6S128689	2.2K
R38	6S128689	2.2K
R39	6S129620	560
R40	6S129620	560
R41	6S127804	4.7K
R42	6S129620	560
R43	6S127804	4.7K
R44	6S129228	330K
	NON-REFERENCED ITEM	
	42S10217A01	STRAP, cable harness

TLN4047A F2-R2 Mute Panel Kit PL-486-O

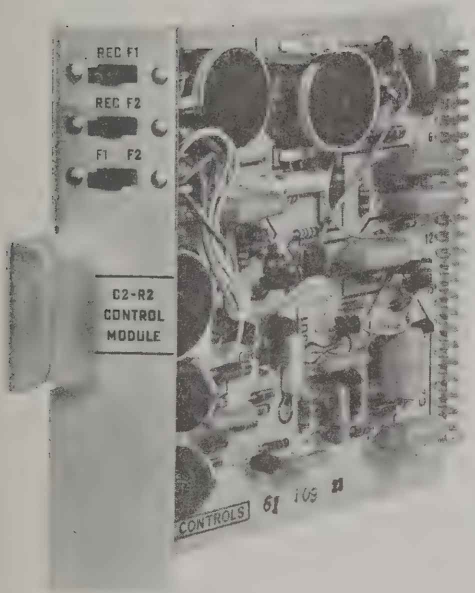
		SWITCH, slide:
S1	40B83204B01	dpdt
S2	40B83468E01	spdt
S3	40B83468E01	spdt
	NON-REFERENCED ITEMS	
	1V80703B19	PANEL ASSY (riveted): incl. ref. parts S1, S2, and S3
	45B83914G01	GUIDE, card: 2 used

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

C2-R2 CONTROL MODULE

MODEL TLN1248A



DESCRIPTION

The TLN1248A C2-R2 Control Module is a fully
ınsistorized, plug-in circuit module for the tone
mote control chassis in Motorola base stations.
l components and circuitry are mounted on a
ırdy card with connecting terminals to mate with
e interconnecting board of the chassis in which
is installed.

FUNCTIONS

This module provides selection of either of two
ceive frequencies or the simultaneous selection
the second transmit and receive frequencies (T2
l R2) by tone command from a remote control
int. A 1750-Hz tone selects the R1 frequency,
1650-Hz tone selects the R2 frequency, and an
50-Hz tone selects the T2 and R2 frequencies.
so, selection of either transmit frequency will set up the corresponding receive frequency after the transmission is made.

3. CIRCUIT DESCRIPTION

a. Selection of R1 Receive Frequency

A 1750-Hz tone present on pin 11 is amplified and clipped in the tone amplifier stage, Q4. After amplification and clipping, the tone passes through the tuned circuit, L2 and C10, and on to the detector stage Q5. With detection, the bistable multivibrator, Q6 and Q7, is activated which applies a positive input to the base of the receive R1 switch transistor, Q11. With this input, the receive R1 switch applies a ground to the R1 channel element through pin 15 which activates the receiver R1 frequency.

When the Q6 and Q7 bistable multivibrator turns on, the R2 mute bistable multivibrator, Q9 and Q10, is disabled which removes the drive from the base of the receive R2 switch transistor, Q12. Upon removal of the base drive from Q12, the ground is removed from the R2 channel element which disables the receiver R2 frequency.

b. Selection of R2 Receive Frequency

A 1650-Hz tone from the remote control point entering on pin 11 is amplified and clipped in the tone amplifier stage, Q4. After amplification and clipping, the tone passes through the tuned circuit, L3 and C16 into the detector stage, Q8. With detection, the bistable multivibrator, Q9 and Q10 is activated which applies a positive input to the base of the receive R2 switch Q12. With this input, the receive R2 switch applies a ground to the R2 channel element through pin 17 which activates the receiver R2 frequency.

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REVISIONS

63P81004E97-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4046A	C3	WAS 8D82905G02, .022 uF	Q2 BASE
	R1	WAS 6S129667, 22K	L1 TAP
	R3	WAS 6S2028, 2.2K	Q1 EMITTER
	R5	WAS 6S129805, 1K	
	R22	WAS 6S131275, 220 ±5%	Q5 EMITTER
	R23	WAS 6S2028, 2.2K ±5%	
	R34	WAS 6S131275, 220 ±5%	Q8 EMITTER
	R35	WAS 6S2028, 2.2K ±5%	
TLN4046A-1	C13, 14, 19, 20	WERE 8D82905G02 .022 uF	BASE OF Q6, Q7, Q9, Q10
TLN4046A-2			

PARTS LIST

TLN4046A F2-R2 Mute Decoder Board PL-485-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 v; unl stated
C1	8D84326A15	.0069 ±2%
C2	21D82187B29	.001; 100 v
C3	23D82783B08	1 ±20%; 35 v
C4	8D82905G02	.022
C5	21D82187B29	.001; 100 v
C6	8D82905G11	0.22
C7	21D82187B29	.001; 100 v
C8	8D82905G11	0.22
C9	23K865136	15 ±20%; 25 v
C10	8D84326A16	.0077 ±2%
C11	21D82187B29	.001; 100 v
C12	8D82905G11	0.22
C13	8D82905G11	0.22
C14	8D82905G11	0.22
C15	8D82905G11	0.22
C16	8D84326A17	.00865 ±2%
C17	21D82187B29	.001; 100 v
C18	8D82905G11	0.22
C19	8D82905G11	0.22
C20	8D82905G11	0.22
C21	8D82905G11	0.22
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 11	48C82392B03	silicon
		COIL ASSEMBLY, inductor:
L1 thru 3	1V80702B11	1H; incl ground clip
		TRANSISTOR: (SEE NOTE)
Q1	48R869570	N-P-N; M9570
Q2	48R869571	P-N-P; M9571
Q3	48R869567	N-P-N; M9567
Q4	48R869570	N-P-N; M9570
Q5	48R869570	N-P-N; M9570
Q6	48R869571	P-N-P; M9571
Q7	48R869570	N-P-N; M9570
Q8	48R869570	N-P-N; M9570
Q9	48R869571	P-N-P; M9571
Q10	48R869570	N-P-N; M9570
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1	6S131526	18K ±5%
R2	6S128689	2.2K
R3	6S5652	2.7K ±5%; 1/2 w
R4	6S131275	220 ±5%
R5	6S129681	1.5K ±5%
R6	6S128689	2.2K
R7	6S6229	1K; 1/2 w
R8	6S129225	10K
R9	6S127802	1K
R10	6S6229	1K; 1/2 w
R11	6S124A08	22 ±5%
R12	6S129299	68K ±5%
R13	6S129886	27K ±5%
R14	6S129805	1K ±5%
R15	6S129620	560
R16	6S129231	3.3K
R17	18C83083G03	var; 25K
R18	6S129231	3.3K
R19	18C83083G03	var; 25K
R20	6S129755	10
R21	6S129667	22K ±5%
R22	6D84444A07	221 ±1%
R23	6D84444A09	2.43 ±1%
R24	6S129805	1K ±5%
R25	6S128689	2.2K
R26	6S129620	560
R27	6S129620	560
R28	6S127804	4.7K
R29	6S129620	560
R30	6S129228	330K
R31	6S127804	4.7K
R32	6S129231	3.3K
R33	6S131526	18K ±5%
R34	6D84444A07	221 ±1%
R35	6D84444A08	2.21K ±1%
R36	6S129805	1K ±5%
R37	6S128689	2.2K
R38	6S128689	2.2K
R39	6S129620	560
R40	6S129620	560
R41	6S127804	4.7K
R42	6S129620	560
R43	6S127804	4.7K
R44	6S129228	330K
	NON-REFERENCED ITEM	
	42S10217A01	STRAP, cable harness

TLN4047A F2-R2 Mute Panel Kit PL-486-O

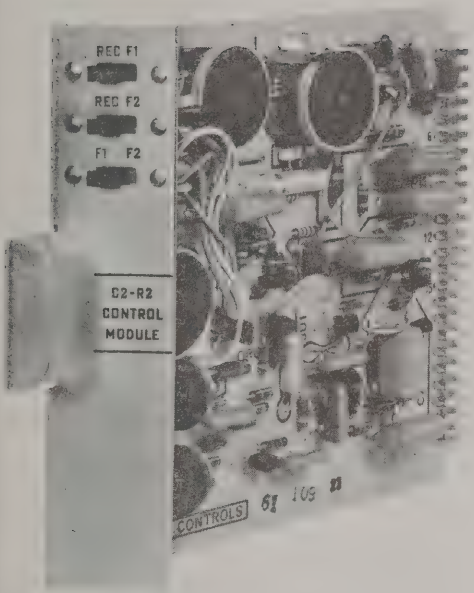
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH, slide:
S1	40B83204B01	dpdt
S2	40B83468E01	spdt
S3	40B83468E01	spdt
	NON-REFERENCED ITEMS	
	1V80703B19	PANEL ASSY (riveted); incl. ref. parts S1, S2, and S3
	45B83914G01	GUIDE, card: 2 used

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

C2-R2 CONTROL MODULE

MODEL TLN1248A



DESCRIPTION

The TLN1248A C2-R2 Control Module is a fully nsistorized, plug-in circuit module for the tone note control chassis in Motorola base stations. components and circuitry are mounted on a rdy card with connecting terminals to mate with interconnecting board of the chassis in which s installed.

FUNCTIONS

This module provides selection of either of two ceive frequencies or the simultaneous selection the second transmit and receive frequencies (T2 l R2) by tone command from a remote control nt. A 1750-Hz tone selects the R1 frequency, 1650-Hz tone selects the R2 frequency, and an 50-Hz tone selects the T2 and R2 frequencies. so, selection of either transmit frequency will set up the corresponding receive frequency after the transmission is made.

3. CIRCUIT DESCRIPTION

a. Selection of R1 Receive Frequency

A 1750-Hz tone present on pin 11 is amplified and clipped in the tone amplifier stage, Q4. After amplification and clipping, the tone passes through the tuned circuit, L2 and C10, and on to the detector stage Q5. With detection, the bistable multivibrator, Q6 and Q7, is activated which applies a positive input to the base of the receive R1 switch transistor, Q11. With this input, the receive R1 switch applies a ground to the R1 channel element through pin 15 which activates the receiver R1 frequency.

When the Q6 and Q7 bistable multivibrator turns on, the R2 mute bistable multivibrator, Q9 and Q10, is disabled which removes the drive from the base of the receive R2 switch transistor, Q12. Upon removal of the base drive from Q12, the ground is removed from the R2 channel element which disables the receiver R2 frequency.

b. Selection of R2 Receive Frequency

A 1650-Hz tone from the remote control point entering on pin 11 is amplified and clipped in the tone amplifier stage, Q4. After amplification and clipping, the tone passes through the tuned circuit, L3 and C16 into the detector stage, Q8. With detection, the bistable multivibrator, Q9 and Q10 is activated which applies a positive input to the base of the receive R2 switch Q12. With this input, the receive R2 switch applies a ground to the R2 channel element through pin 17 which activates the receiver R2 frequency.

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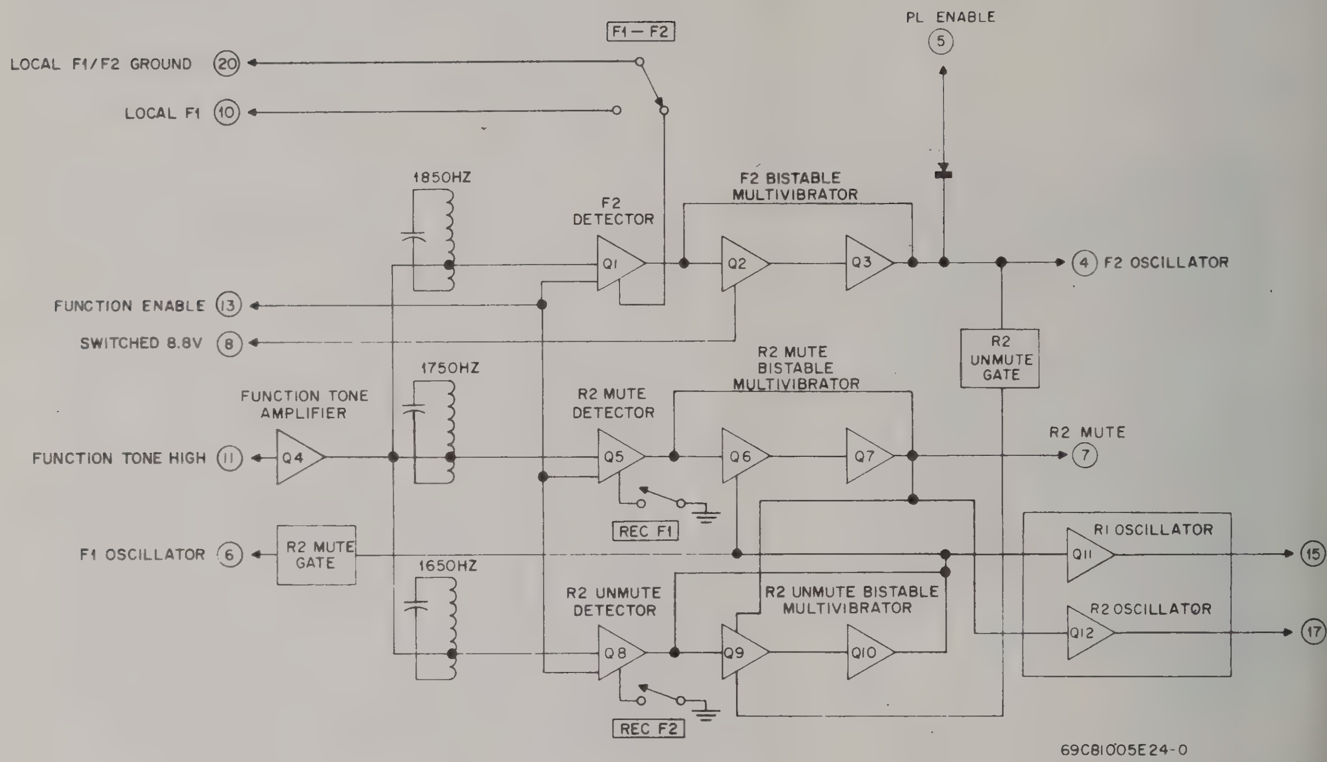


Functional Block Diagram

When the Q9 and Q10 bistable multivibrator turns on, the R2 mute bistable multivibrator, Q6 and Q7, is turned off by a positive pulse sent from the Q9 collector circuit through diode CR9 to the collector of Q7. This interlocks the R2 mute and R2 unmute bistable multivibrators to prevent simultaneous operation of both.

c. Selection of F2 Transmit and Receive Frequency

An 1850-Hz tone applied to pin 11 is amplified and clipped in the tone amplifier stage, Q4. After amplification and clipping, the tone will pass through the tuned circuit, L1-C1, and into the tone detector Q1. Upon detection it triggers the F2 bistable multivibrator, Q2-Q3, to turn it on. When the multivibrator turns on, the collector of Q3 goes to ground potential and applies a ground to module pin 4 which applies a ground to the F2 channel element.

When the Q2-Q3 multivibrator turns on, a negative-going transient pulse is coupled through capacitor C21 and diode CR11 to the R2 unmute bistable multivibrator. When the R2 unmute bistable multivibrator, Q9-Q10, is triggered, the R2 mute and receive R2 switch circuits are operated as described in the preceding paragraphs under "Selection of R2 Receive Frequency".

d. Activation of R1 Receive Frequency when F1 is Selected

When a 1950-Hz tone command is sent to the system to select the F1 channel, the T1 channel element receives an activating ground. This ground appears at pin 6 of the module and induces a negative transient through capacitor C15, resistor R30, and diode CR8. This pulse causes the R2 mute bistable multivibrator to turn on which applies a positive output to the receive R1 switch stage, Q11 via the Q9 and Q10 bistable multivibrator. The

output causes the transistor, Q11, to saturate, applying a ground to the R1 channel element via pin 15, turning the F1 receive frequency on.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To initially determine the location of the fault, operate the station locally and initiate the desired function tone from the module. If the desired function occurs, the module is functioning properly. If the function does not occur, the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A Module Extension Board, and reinsert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module:

PIN NUMBER	CONNECTION
1, 2, 13	Ground
4	10 kilohms to pin 12
5	10 kilohms to pin 12
8	to pin 12
11	Oscillator input
12	A+; 13.6 volts dc
15	10 kilohms to pin 12
16	to ground
17	10 kilohms to pin 12

c. Module Malfunction Location Techniques

(1) F2 Control Stages

(a) Connect a dc voltmeter across pin 4 and pin 2.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q1. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1850 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage, Q1, then the bistable multivibrator, Q2 and Q3. If the change of state occurs, look to the function tone amplifier for a malfunction.

(2) Function Tone Amplifier Stage

(a) Connect an ac voltmeter from the capacitor connected to the collector of Q4 to ground.

(b) Connect an audio oscillator from pin 11 to ground. Adjust the oscillator output to -10 dBm at 1800 Hz.

(c) The measured output should be at least +10 dBm. When viewed with an oscilloscope, the waveform should be well into a clipped condition.

(d) If the previous conditions are not attained, measure the voltages on the function tone detector stage.

(3) R2 Mute Stages

(a) Connect a dc voltmeter across the collector of transistor Q7 and ground (pin 1).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q5. The output level must not exceed 1 volt.

(c) Adjust the oscillator frequency to 1750 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage, Q5, then the bistable multivibrator, Q6 and Q7. If the change of state occurs, look to the function tone amplifier for a malfunction.

(4) R2 Unmute Stages

(a) Connect a dc voltmeter across the collector of transistor Q10 and ground (pin 1).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of transistor Q8. The output level from the oscillator must not exceed 1 volt.

(c) Adjust the oscillator frequency to 1650 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the multivibrator does not change state, check the detector stage, Q8, then the bistable multivibrator, Q9 and Q10. If the change of state occurs, check the R2 mute stages as previously described.

(5) Receive R1 Switch Stage

(a) Connect a dc voltmeter from the collector of Q11 to ground (pin 16).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q5. The output level from the oscillator must not exceed 1 volt.

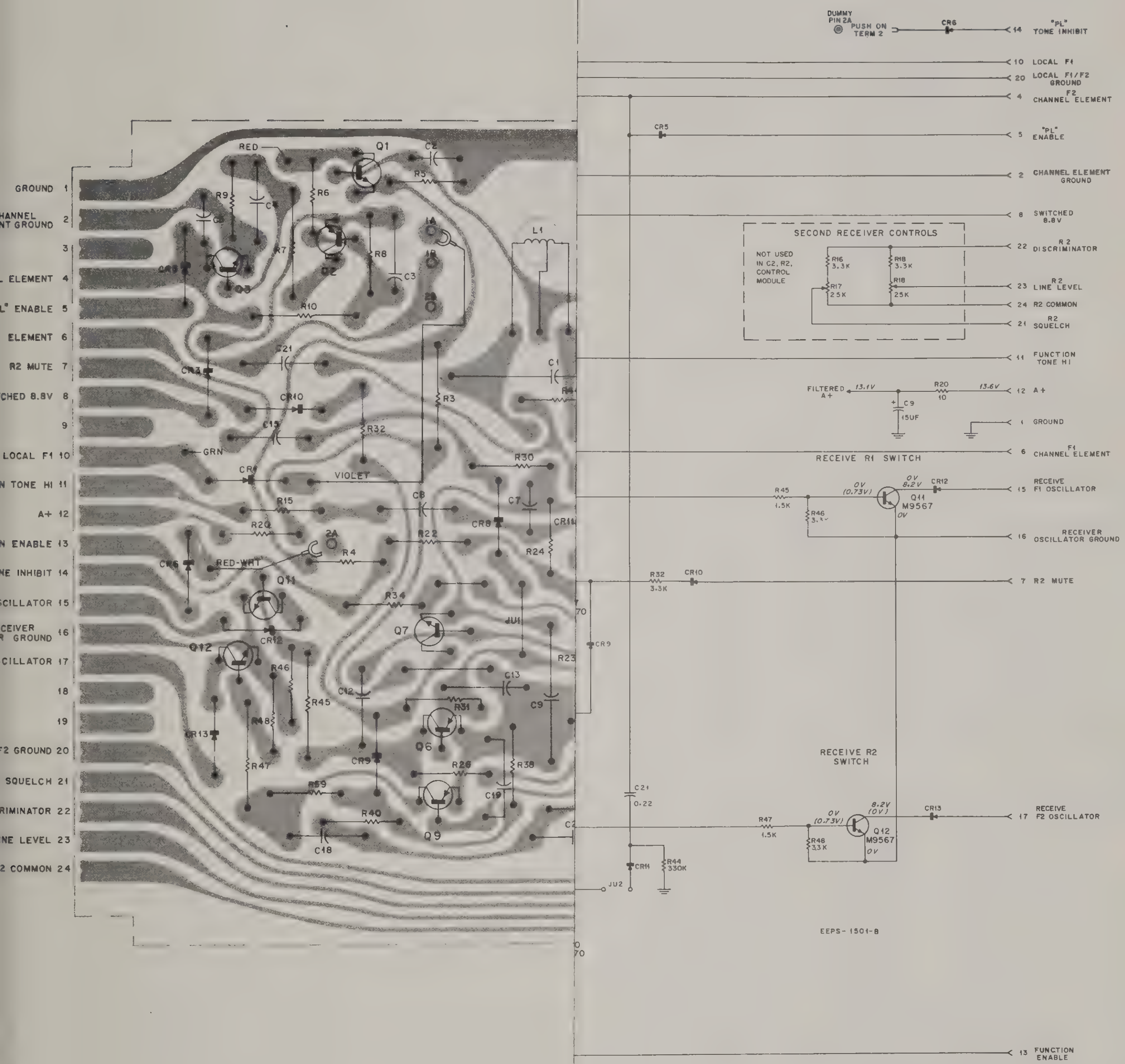
(c) Adjust the oscillator frequency to 1750 Hz. The voltmeter reading should fall to zero volts, indicating that the receive R1 switch is operating. If the switch does not operate, check the Q11 stage, then the bistable multivibrator, Q6 and Q7 stage, and the detector stage, Q5.

(6) Receive R2 Switch Stage

(a) Connect a dc voltmeter from the collector of Q12 to ground (pin 16).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of transistor Q8. The output level from the oscillator must not exceed 1 volt.

(c) Adjust the oscillator frequency to 1650 Hz. The voltmeter reading should fall to zero volts, indicating that the receive R2 switch is operating. If the switch does not operate, check the Q12 stage, then the bistable multivibrator stage, Q9 and Q10, and the detector stage, Q8.



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

C2-R2 Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81004E99-C
3/1/72-UP

C2-R2 CONTROL MODULE

(c) Adjust the oscillator frequency to 1650 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the multivibrator does not change state, check the detector stage, Q8, then the bistable multivibrator, Q9 and Q10. If the change of state occurs, check the R2 mute stages as previously described.

(5) Receive R1 Switch Stage

(a) Connect a dc voltmeter from the collector of Q11 to ground (pin 16).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q5. The output level from the oscillator must not exceed 1 volt.

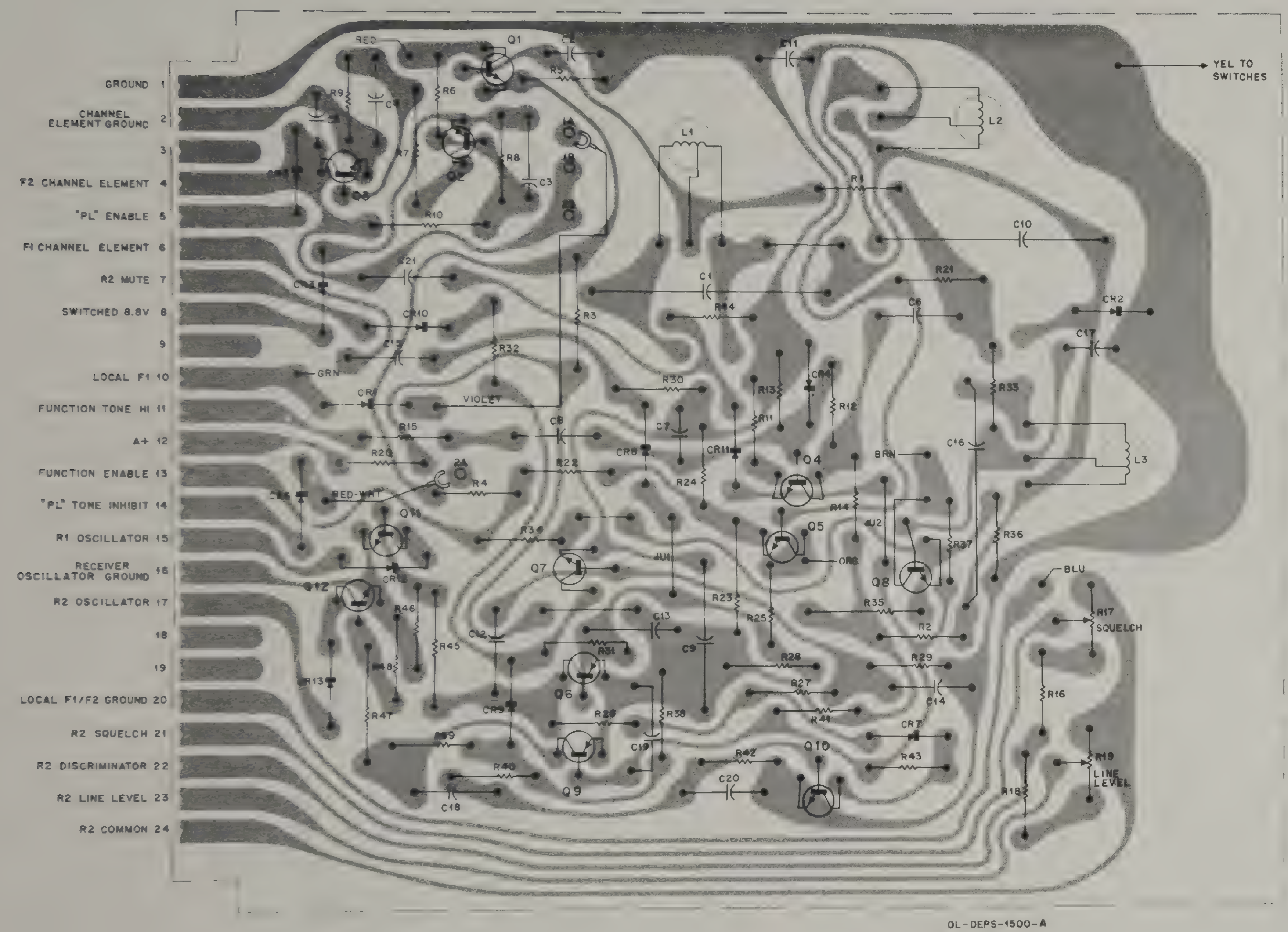
(c) Adjust the oscillator frequency to 1750 Hz. The voltmeter reading should fall to zero volts, indicating that the receive R1 switch is operating. If the switch does not operate, check the Q11 stage, then the bistable multivibrator, Q6 and Q7 stage, and the detector stage, Q5.

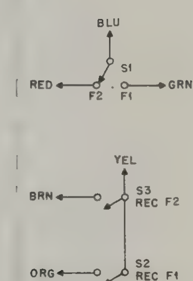
(6) Receive R2 Switch Stage

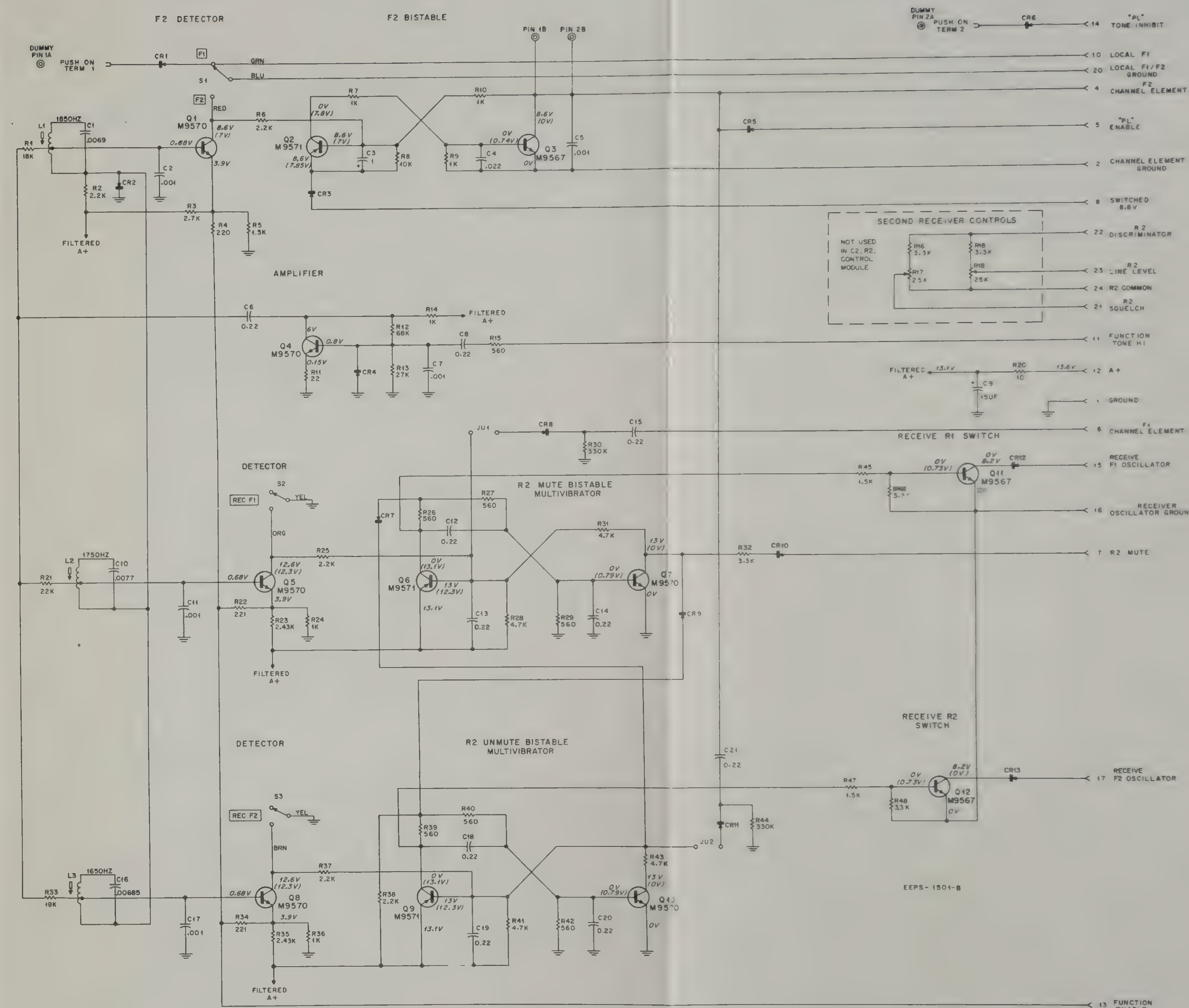
(a) Connect a dc voltmeter from the collector of Q12 to ground (pin 16).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of transistor Q8. The output level from the oscillator must not exceed 1 volt.

(c) Adjust the oscillator frequency to 1650 Hz. The voltmeter reading should fall to zero volts, indicating that the receive R2 switch is operating. If the switch does not operate, check the Q12 stage, then the bistable multivibrator stage, Q9 and Q10, and the detector stage, Q8.







PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

C2-R2 Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81004E99-C
3/1/72-UP

C2-R2 CONTROL MODULE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R32	6S129231	3.3K
R33	6S131526	18K ±5%
R34	6D84444A07	221 ±1%
R35	6D84444A08	2.21K ±1%
R36	6S129805	1K ±5%
R37	6S128689	2.2K
R38	6S128689	2.2K
R39	6S129620	560
R40	6S129620	560
R41	6S127804	4.7K
R42	6S129620	560
R43	6S127804	4.7K
R44	6S129228	330K
R45	6S6038	1.5K; 1/2 w
R46	6S129231	3.3K
R47	6S6038	1.5K; 1/2 w
R48	6S129231	3.3K
	NON-REFERENCED ITEM	
	42S10217A01	STRAP, cable harness

TLN4049A (2-R2 Decoder Panel Kit PL-482-O

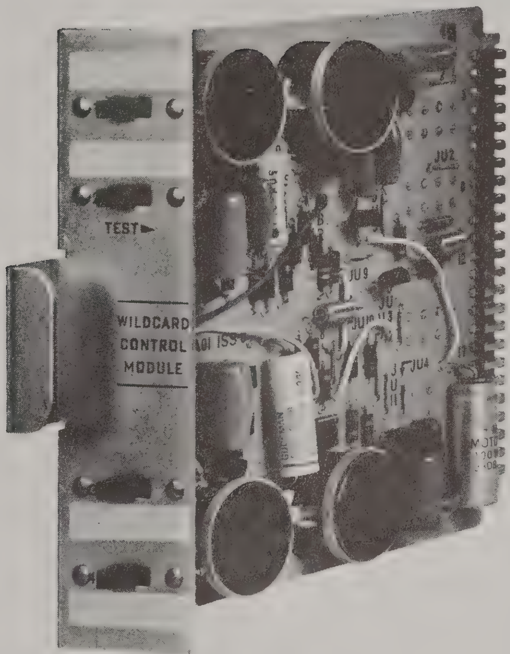
		SWITCH, slide
S1	40B83204B01	dpdt
S2	40B83468E01	spdt
S3	40B83468E01	spdt
	NON-REFERENCED ITEMS	
	1V80703B19	PANEL ASSY (riveted); incl. ref parts S1, S2 and S3
	45B83914G01	GUIDE, card: 2 used

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

"WILD CARD" CONTROL MODULE

MODEL TLN1252A



1. DESCRIPTION

The TLN1252A "Wild Card" Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting pins to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

a. General

This module provides four tone-activated control circuits to operate distantly located functions. Each individual circuit, when operated, provides a ground for a 100-milliampere circuit to operate a function, or it may operate the relay in the Model TLN4151A Relay Kit, available separately for installation on the module. This relay kit provides switched contacts for higher currents and complete isolation of the switched circuit from the module. Refer to the following detail for dc contact ratings; the relay will control a 115 volts ac resistive load at 1 ampere.

3. APPLICATIONS

In general, the "Wild Card" control module may be used to provide on-off control for a multitude of functions. These typical applications could include a manual override for tower light control,

"WILD CARD" CONTROL MODULE

MOTOROLA INC. **Communications Division**
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REVISIONS

63P81004E99-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4048A	C3	WAS 8D82905G02, .022 uF	Q2 BASE
	R1	WAS 6S129667, 22K	L1 TAP
	R3	WAS 6S2028, 2.2K	Q1 EMITTER
	R5	WAS 6S129805, 1K	
	R22	WAS 6S131275, 220 ±5%	Q5 EMITTER
	R23	WAS 6S2028, 2.2K ±5%	
	R34	WAS 6S131275, 220 ±5%	Q8 EMITTER
	R35	WAS 6S2028, 2.2K ±5%	
TLN4048A-1	C13, 14, 19, 20	WERE 8D82905G02 .022 uF	BASE OF Q6, Q7, Q9, Q10
TLN4048A-2			

PARTS LIST

TLN4048A C2-R2 Decoder Board PL-481-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 v; unl. stated
C1	8D84326A15	.0069 ±2%
C2	21D82187B29	.001; 100 v
C3	23D82783B08	1 ±20%; 35 v
C4	8D82905G02	.022
C5	21D82187B29	.001; 100 v
C6	8D82905G11	0.22
C7	21D82187B29	.001; 100 v
C8	8D82905G11	0.22
C9	23K865136	15 ±20%; 25 v
C10	8D84326A16	.0077 ±2%
C11	21D82187B29	.001; 100 v
C12	8D82905G11	0.22
C13	8D82905G11	0.22
C14	8D82905G11	0.22
C15	8D82905G11	0.22
C16	8D84326A17	.00865 ±2%
C17	21D82187B29	.001; 100 v
C18	8D82905G11	0.22
C19	8D82905G11	0.22
C20	8D82905G11	0.22
C21	8D82905G11	0.22
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 13	48C82392B03	silicon
		COIL ASSEMBLY, inductor:
L1 thru 3	1V80702B11	1H; incl. ground clip
		TRANSISTOR: (SEE NOTE)
Q1	48R869570	N-P-N; M9570
Q2	48R869571	P-N-P; M9571
Q3	48R869567	N-P-N; M9567
Q4	48R869570	N-P-N; M9570
Q5	48R869570	N-P-N; M9570
Q6	48R869571	P-N-P; M9571
Q7	48R869570	N-P-N; M9570
Q8	48R869570	N-P-N; M9570
Q9	48R869571	P-N-P; M9571
Q10	48R869570	N-P-N; M9570
Q11	48R869567	N-P-N; M9567
Q12	48R869567	N-P-N; M9567
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R1	6S131526	18K ±5%
R2	6S128689	2.2K
R3	6S5652	2.7K ±5%; 1/2 w
R4	6S131275	220 ±5%
R5	6S129681	1.5K ±5%
R6	6S128689	2.2K
R7	6S6229	1K; 1/2 w
R8	6S129225	10K
R9	6S127802	1K
R10	6S6229	1K; 1/2 w
R11	6S124A08	22 ±5%
R12	6S129299	68K ±5%
R13	6S129886	27K ±5%
R14	6S129805	1K ±5%
R15	6S129620	560
R16	6S129231	3.3K
R17	18C83083G03	var: 25K
R18	6S129231	3.3K
R19	18C83083G03	var; 25K
R20	6S129755	10
R21	6S129667	22K ±5%
R22	6D84444A07	221 ±1%
R23	6D84444A09	2.43 ±1%
R24	6S129805	1K ±5%
R25	6S128689	2.2K
R26	6S129620	560
R27	6S129620	560
R28	6S127804	4.7K
R29	6S129620	560
R30	6S129228	330K
R31	6S127804	4.7K

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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R45	6S6038	1.5K; 1/2 w
R46	6S129231	3.3K
R47	6S6038	1.5K; 1/2 w
R48	6S129231	3.3K
	NON-REFERENCED ITEM	
	42S10217A01	STRAP, cable harness

TLN4049A C2-R2 Decoder Panel Kit PL-482-O

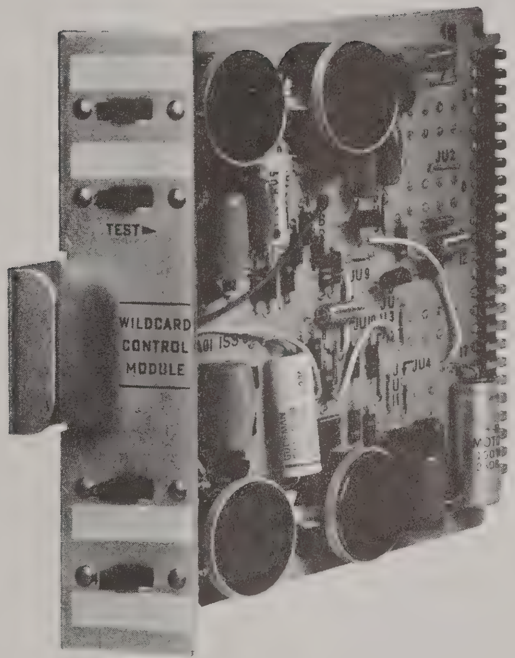
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH, slide
S1	40B83204B01	dpdt
S2	40B83468E01	spdt
S3	40B83468E01	spdt
	NON-REFERENCED ITEMS	
	1V80703B19	PANEL ASSY (riveted); incl. ref parts S1, S2 and S3
	45B83914G01	GUIDE, card: 2 used

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

"WILD CARD" CONTROL MODULE

MODEL TLN1252A



1. DESCRIPTION

The TLN1252A "Wild Card" Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting pins to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

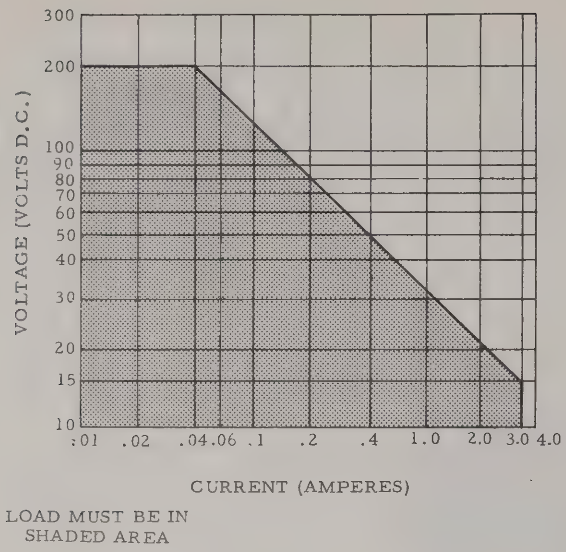
a. General

This module provides four tone-activated control circuits to operate distantly located functions. Each individual circuit, when operated, provides a ground for a 100-milliampere circuit to operate a function, or it may operate the relay in the Model TLN4151A Relay Kit, available separately for installation on the module. This relay kit provides switched contacts for higher currents and complete isolation of the switched circuit from the module. Refer to the following detail for dc contact ratings; the relay will control a 115 volts ac resistive load at 1 ampere.

3. APPLICATIONS

In general, the "Wild Card" control module may be used to provide on-off control for a multitude of functions. These typical applications could include a manual override for tower light control,

"WILD CARD" CONTROL MODULE



AEPS-1527-O

Relay Contact DC Current Ratings

switching of battery charging and equalizing equipment, antenna selection, operation of sirens or public address equipment, remote transfer of lines, or test running of emergency power sources.

4. CIRCUIT CONNECTIONS

a. Operation Without TLN4151A Relay Kit

When the module is used to operate external functions directly without relays, jumpers JU1 through JU4 should be in place. When the appropriate Function Bistable Multivibrator is operated, a ground appears at the respective terminal contact as follows:

Operating Tone-Hz	Bistable Operated	Ground Appears At Contact No.
1350	No. 1	3
1250	No. 2	8
1150	No. 3	16
1050	No. 4	23

b. Operation With TLN4151A Relay Kit

When a Model TLN4151A Relay Kit is installed to provide additional switched circuit current-handling capability for a function bistable multivibrator on the module, jumpers must be removed for proper operation of the relay contact circuitry. Refer to the following table.

When Relay is Installed For Bistable No.:	Remove Jumper No.:
1	JU1
2	JU2
3	JU3
4	JU4

NOTE

For control of external devices using the multivibrator outputs with or without the relay kits, external connections must be made directly to the appropriate pins on the interconnect board. Refer to the schematic diagram for connection information.

c. Paired Reset Function Bistable Multivibrator Operation

For certain applications, it may be desirable to operate two of the function bistable multivibrators as a pair. In this condition, the actuation of one of the pair causes its mate to go to its unactuated state. The paired functioning is controlled by specific jumpers. Refer to the following table:

To Operate Bistable Multivibrators As Pairs	Connect Jumpers
Functions No. 1 & 2	JU5, JU6
Functions No. 3 & 4	JU7, JU8

The bistable multivibrator circuitry is established to provide an "on" function in the Function No. 1 and Function No. 3 bistable multivibrators whenever the power is applied, and also return to this condition after restoration of power following an interruption.

d. Four-Bistable Memory or Independent Bistable Operation

When jumpers JU5, JU6, JU7, JU8, and JU9 are removed, each bistable multivibrator can be operated independently, and reset only as a group by the interruption of A+ power on pin 19. The tone detector is unaffected by the reset interruption, as it is supplied with A+ from the normal pin 12.

5. THEORY OF OPERATION

a. Introduction

The TLN1252A "Wild Card" Module comprises four detector and bistable multivibrator circuits

driven by a common tone amplifier-clipper stage. The tone detector and amplifier stages are identical except for the acceptance frequency of each tuned circuit in the tone detector stage. The following circuit description applies for each individual Function Stage, considering the appropriate tone frequency used, when necessary.

b. Circuit Operation

When a function tone enters the module on pin 11, it is amplified and clipped to a +16 dBm level in transistor stage Q1. A 1350 Hz tone will pass through the tuned circuit (L1-C4) into the tone detector stage (Q2). When it is detected, it causes the Function No. 1 Bistable Multivibrator (Q3-Q4) to change state, causing the collector of Q4 to go to ground. If a relay is not used with the Function No. 1 stage, this ground is applied through the jumper (JU1) to pin 3 of the module to operate the external circuit. The circuit remains in this actuated condition until the A+ voltage to the bistable multivibrator, fed through pin 19, is momentarily interrupted to reset all stages.

When a TLN4151A Relay Kit is installed in the stage, operation is as previously described, except that the ground at the collector of Q4 is applied to the relay coil, which operates the relay. The external circuit is controlled by the relay contacts connected to module pins 3, 4, and 5 with the jumper (JU1) removed.

The foregoing description is applicable to Function Stages No. 2, 3, and 4, when the appropriate function tone frequency is used, and the corresponding detector and bistable multivibrator stages are considered. Refer to the schematic diagram for specific details.

6. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired function is performed, then the bistable is functioning properly. If the function does not perform, then the bistable is at fault.

b. Servicing the Module

(1) Servicing The Module In The Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A Printed Circuit Service Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing The Module Out Of The Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 13	Ground
11	Audio Oscillator input
12	A+ 13.6 volts dc

c. Module Malfunction Location Techniques

(1) Bistable Multivibrator

(a) Connect a dc voltmeter between pin 1 and the collector of Q4 (Q7, Q10, Q13).

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q1. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1350 (1250, 1150, 1050) Hz. The voltmeter reading should fall to zero volts, indicating that the bistable multivibrator has changed state. If the change of state does not occur, check detector stage Q2 (Q5, Q8, Q11) then bistable multivibrator Q3-Q4 (Q6-Q7, Q9-Q10, Q12-Q13). If the change of state occurs, look to the function tone amplifier for a malfunction.

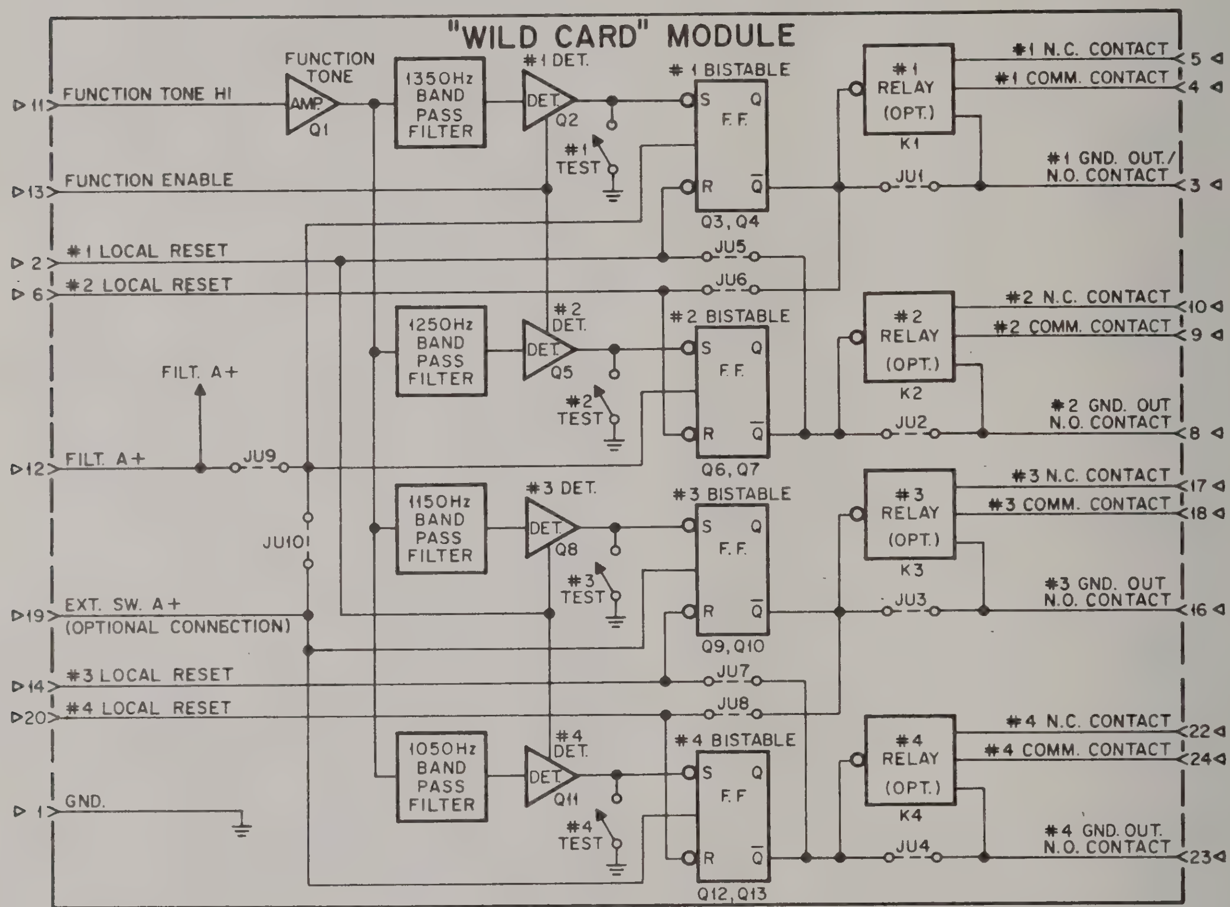
(2) Function Tone Amplifier Stage

(a) Connect an ac voltmeter from the capacitor connected to the collector of Q1 to ground.

(b) Connect an audio oscillator from pin 11 to ground. Adjust the oscillator output to -10 dBm at 1200 Hz.

(c) The measured output should be at least +10 dBm. When viewed with an oscilloscope, the waveform should be well into a clipped condition.

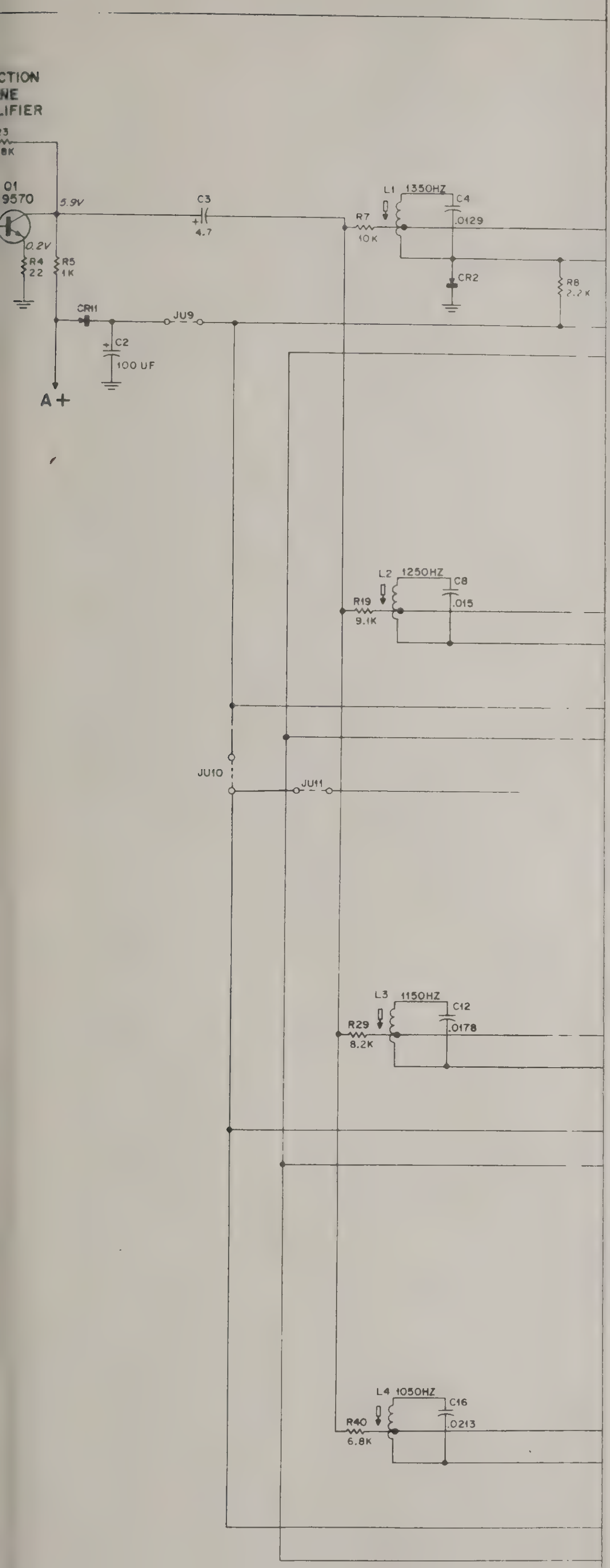
(d) If the aforementioned conditions are not attained, measure the voltages on the function tone amplifier stage.

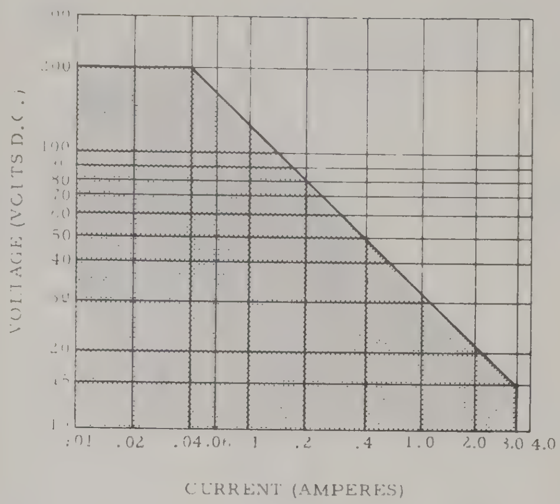


CEPS-7405-0

NOTE:
1. JU5 & 6 CROSS COUPLE BISTABLES #1 & #2.
2. JU7 & 8 CROSS COUPLE BISTABLES #3 & #4.
3. JU1 THRU 4 ARE CUT WHEN THE OPTIONAL RELAYS ARE INSTALLED.
4. JU7, 8 & 10 ARE CUT TO ALLOW BISTABLES #3 & #4 TO RESET INDEPENDENTLY UPON A LOSS OF EXT. SW. A+. BISTABLES #1 & #2 MAY BE OPERATED IN THE SAME MANNER BY INSTALLING JU10 AND CUTTING JU5, 6 & 9.

Functional Block Diagram





LOAD MUST BE IN SHADED AREA

AEPS-1527-O

NOTE

LN4151A RELAY IS AN OPTIONAL ACCESSORY. REFER TO GRAPH FOR RELAY CONTACT RATING.

EPS-4135-O

"WILD CARD" CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Schematic Diagram & Circuit Board Detail
Motorola No. 63P81005E14-J
3/1/72-UP

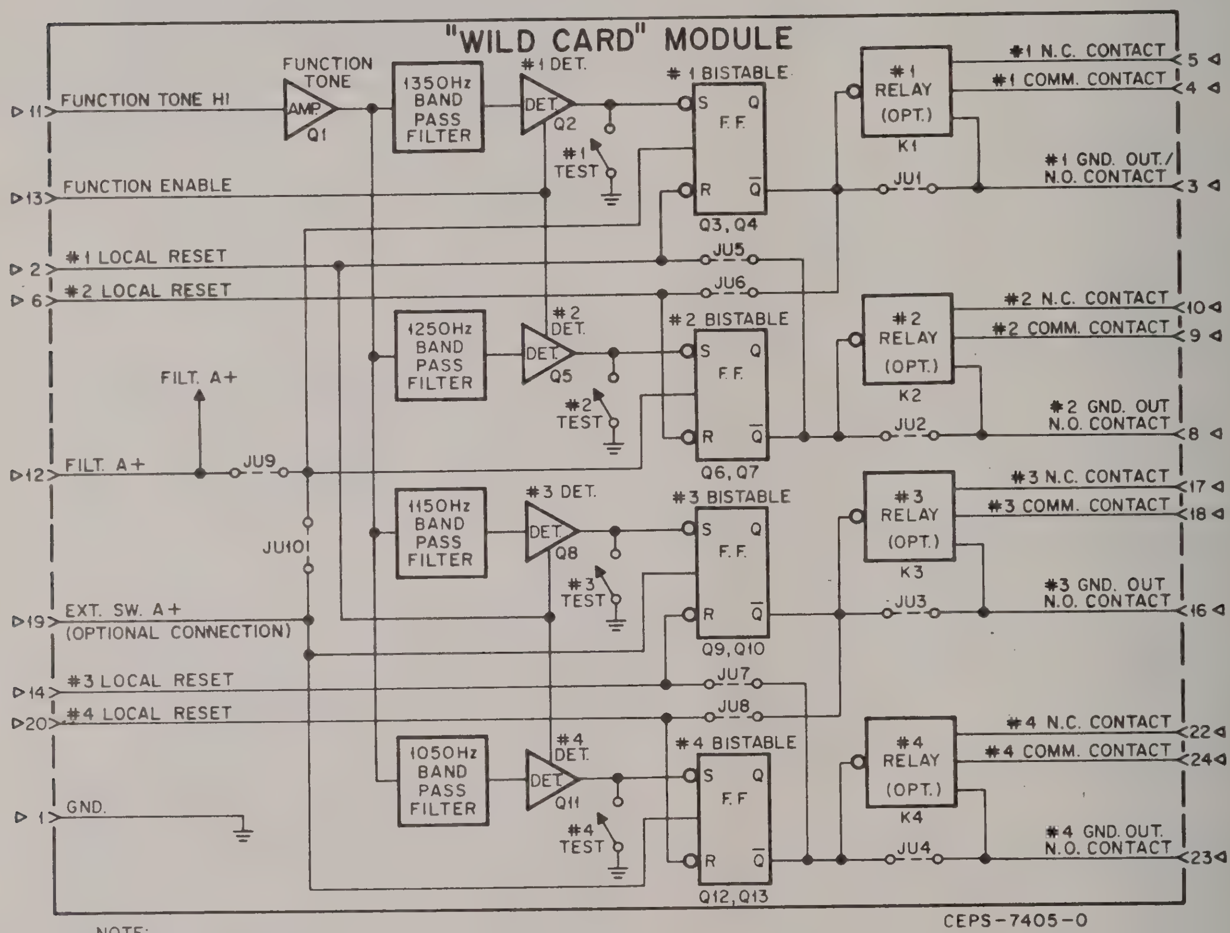
(2) Function Tone Amplifier Stage

(a) Connect an ac voltmeter from the capacitor connected to the collector of Q1 to ground.

(b) Connect an audio oscillator from pin 11 to ground. Adjust the oscillator output to -10 dBm at 1200 Hz.

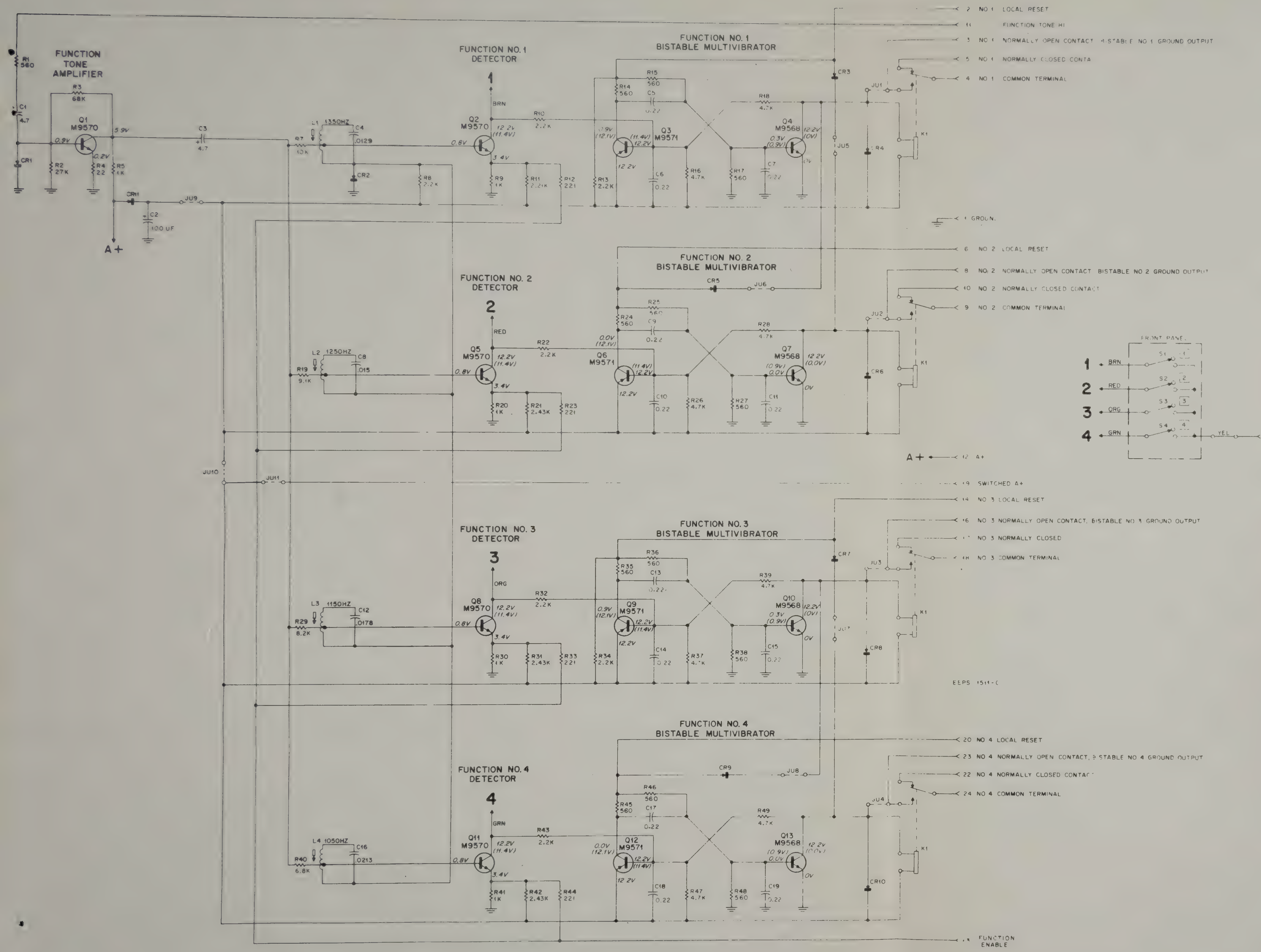
(c) The measured output should be at least +10 dBm. When viewed with an oscilloscope, the waveform should be well into a clipped condition.

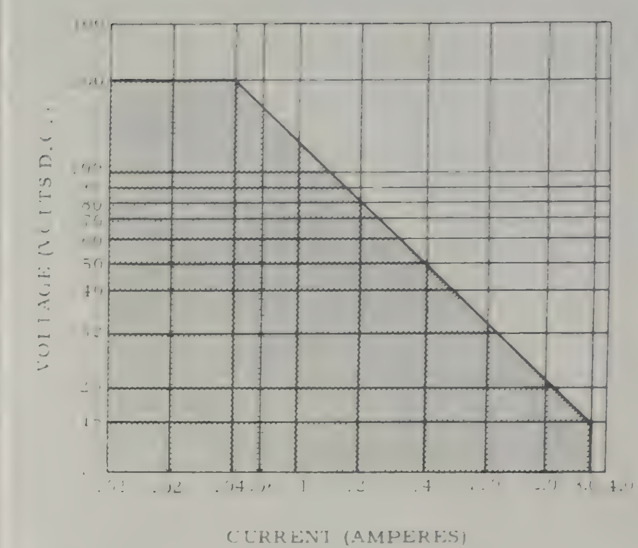
(d) If the aforementioned conditions are not attained, measure the voltages on the function tone amplifier stage.



NOTE:
1. JU5 & 6 CROSS COUPLE BISTABLES #1 & #2.
2. JU7 & 8 CROSS COUPLE BISTABLES #3 & #4.
3. JU1 THRU 4 ARE CUT WHEN THE OPTIONAL RELAYS ARE INSTALLED.
4. JU7, 8 & 10 ARE CUT TO ALLOW BISTABLES #3 & #4 TO RESET INDEPENDENTLY UPON A LOSS OF EXT. SW. A+. BISTABLES #1 & #2 MAY BE OPERATED IN THE SAME MANNER BY INSTALLING JU10 AND CUTTING JU5, 6 & 9.

Functional Block Diagram





LOAD MUST BE IN SHADED AREA

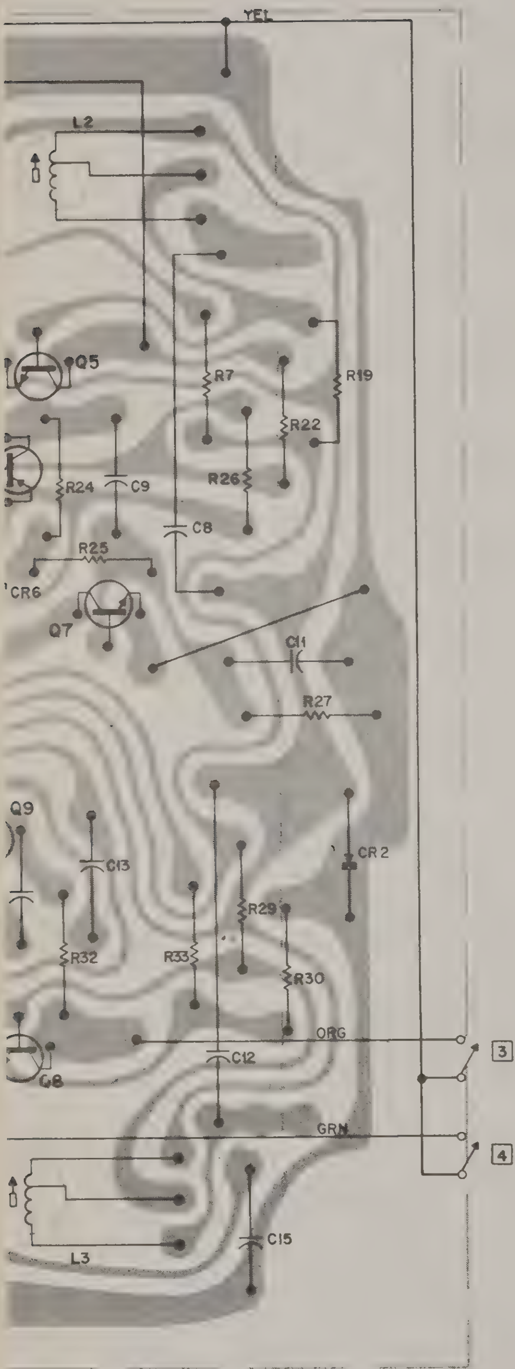
AEPS-1527-O

EPS-4135-O

"WILD CARD" CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Schematic Diagram & Circuit Board Detail
Motorola No. 63P81005E14-J
3/1/72-UP

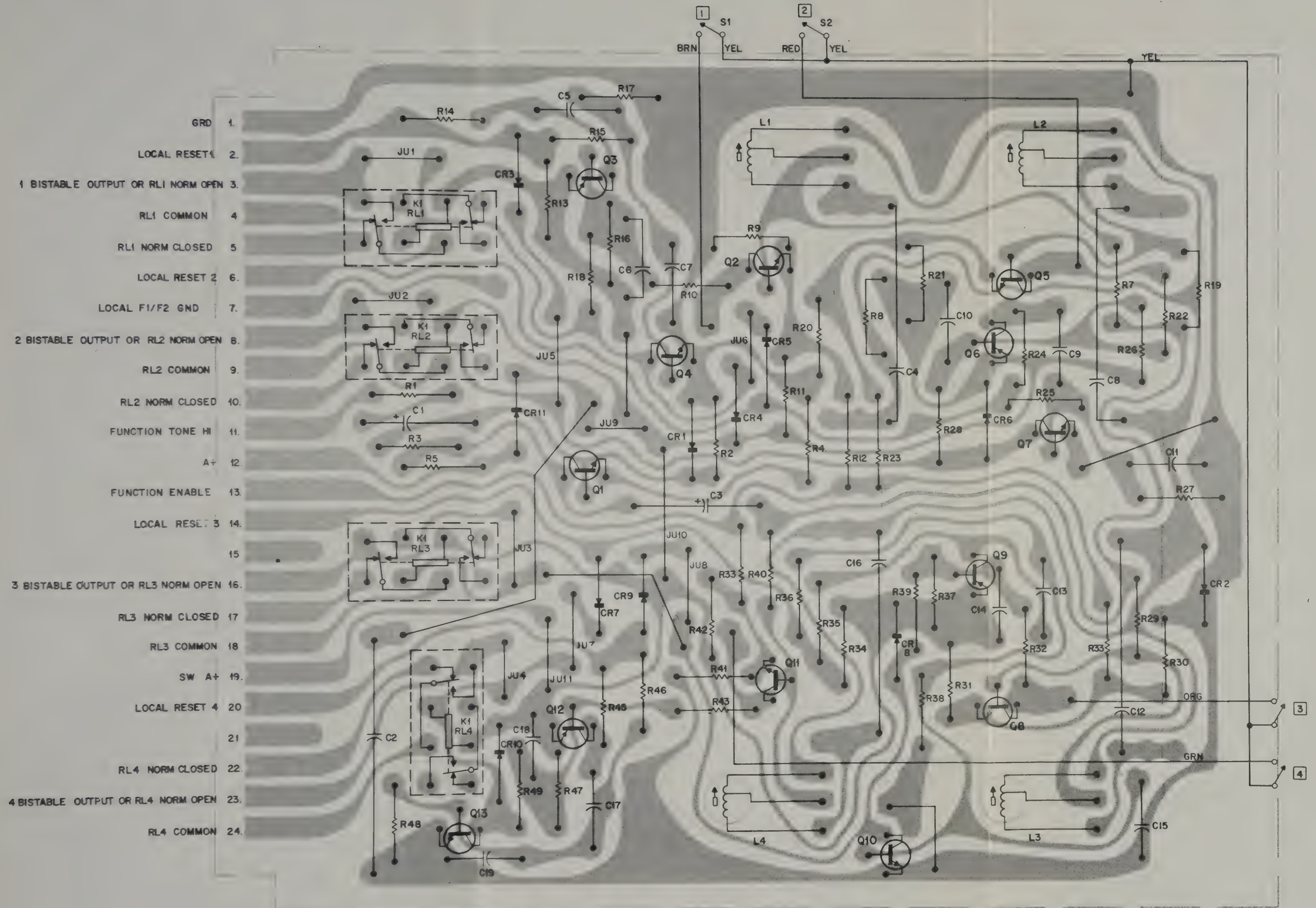


OL-DEPS-1510-D
BD-DEPS-1509 A

REVISIONS

63P81005E

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATIO
TLN4054A	C16	WAS 8D84326A33	PARTS LI
	R7	WAS 6S129236 15K	L1 TAP
	R11	WAS 6S129804 2.2K ±5%	Q2 EMITT
	R12	WAS 6S131275 220 ±5%	Q2 EMITT
	R19	WAS 6S129236 15K	L2 TAP
	R21	WAS 6S129804 2.2K ±5%	Q5 EMITT
	R23	WAS 6S131275 220 ±5%	Q5 EMITT
	R29	WAS 6S129887 12K	L3 TAP
	R31	WAS 6S129804 2.2K ±5%	Q8 EMITT
	R33	WAS 6S131275 220 ±5%	Q8 EMITT
	R40	WAS 6S129887 12K	L4 TAP
	R42	WAS 6S129804 2.2K ±5%	Q11 EMIT
	R44	WAS 6S131275 220 ±5%	Q11 EMIT
TLN4054A-1	C6, C7, C10, C11, C14, C15, C18, C19	WERE 8D82905G02 .022 uF	BASE Q3, Q6, Q7, Q Q10, Q12,
TLN4054A-2			



OL-DEPS-1510-D
BD-DEPS-1509-A

REVISIONS

63P81005E14-J

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4054A	C16	WAS 8D84326A33	PARTS LIST
	R7	WAS 6S129236 15K	L1 TAP
	R11	WAS 6S129804 2.2K ±5%	Q2 EMITTER
	R12	WAS 6S131275 220 ±5%	Q2 EMITTER
	R19	WAS 6S129236 15K	L2 TAP
	R21	WAS 6S129804 2.2K ±5%	Q5 EMITTER
	R23	WAS 6S131275 220 ±5%	Q5 EMITTER
	R29	WAS 6S129887 12K	L3 TAP
	R31	WAS 6S129804 2.2K ±5%	Q8 EMITTER
	R33	WAS 6S131275 220 ±5%	Q8 EMITTER
	R40	WAS 6S129887 12K	L4 TAP
	R42	WAS 6S129804 2.2K ±5%	Q11 EMITTER
	R44	WAS 6S131275 220 ±5%	Q11 EMITTER
TLN4054A-1	C6, C7, C10, C11, C14, C15, C18, C19	WERE 8D82905G02 .022 uF	BASE Q3, Q4, Q6, Q7, Q9, Q10, Q12, Q13
TLN4054A-2			

PARTS LIST

TLN4054A Wildcard Module Board PL-473-O

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 V: unl stated
C1	23K865137	4.7 ±20%; 25 V
C2	23D82601A25	100 +150-10%: 20 V
C3	23K865137	4.7 ±20%; 25 V
C4	8D84326A20	.0129 ±2%
C5	8D82905G11	0.22
C6	8D82905G11	.22
C7	8D82905G11	.22
C8	8D84326A21	.015 ±2%
C9	8D82905G11	0.22
C10	8D82905G11	.22
C11	8D82905G11	.22
C12	8D84326A22	.0178 ±2%
C13	8D82905G11	0.22
C14	8D82905G11	.22
C15	8D82905G11	.22
C16	8D84326A23	.0213 ±2%
C17	8D82905G11	0.22
C18	8D82905G11	.22
C19	8D82905G11	.22
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 11	48C82392B03	silicon
		COIL ASSEMBLY, inductor:
L1 thru 4	1V80702B11	1 H: incl. ground clip
		TRANSISTOR: (SEE NOTE)
Q1	48R869570	N-P-N: M9570
Q2	48R869570	N-P-N: M9570
Q3	48R869571	P-N-P: M9571
Q4	48R869568	N-P-N: M9568
Q6	48R869571	P-N-P: M9571
Q7	48R869568	N-P-N: M9568
Q8	48R869570	N-P-N: M9570
Q9	48R869571	P-N-P; M9571
Q10	48R869568	N-P-N: M9568
Q11	48R869570	N-P-N; M9570
Q12	48R869571	P-N-P: M9571
Q13	48R869568	N-P-N: M9568
		RESISTOR, fixed: ±10%: 1/4 W: unl stated
R1	6S129620	560
R2	6S127806	27K
R3	6S129144	68K
R4	6S124A09	22 ±5%
R5	6S129805	1K ±5%
R7	6S129668	10K ±5%
R8	6S128689	2.2K
R9	6S129805	1K ±5%
R10	6S128689	2.2K
R11	6D84444A08	2.21K ±1%
R12	6D84444A07	221 ±1%
R13	6S128689	2.2K
R14	6S129620	560
R15	6S129620	560
R16	6S127804	4.7K
R17	6S129620	560
R18	6S127804	4.7K
R19	6S124A72	9.1K ±5%
R20	6S129805	1K ±5%
R21	6D84444A09	2.43K ±1%
R22	6S128689	2.2K
R23	6D84444A07	221 ±1%
R24	6S129620	560
R25	6S129620	560
R26	6S127804	4.7K
R27	6S129620	560
R28	6S127804	4.7K
R29	6S129983	8.2K ±5%
R30	6S129805	1K ±5%
R31	6D84444A09	2.43K ±1%
R32	6S128689	2.2K
R33	6D84444A07	221 ±1%
R34	6S128689	2.2K
R35	6S129620	560
R36	6S129620	560
R37	6S127804	4.7K
R38	6S129620	560

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R39	6S127804	4.7K
R40	6S129237	6.8K ±5%
R41	6S129805	1K ±5%
R42	6D84444A09	2.43K ±1%
R43	6S128689	2.2K
R44	6D84444A07	221 ±1%
R45	6S129620	560
R46	6S129620	560
R47	6S127804	4.7K
R48	6S129620	560
R49	6S127804	4.7K

TLN4055A Wildcard Module Panel PL-474-O

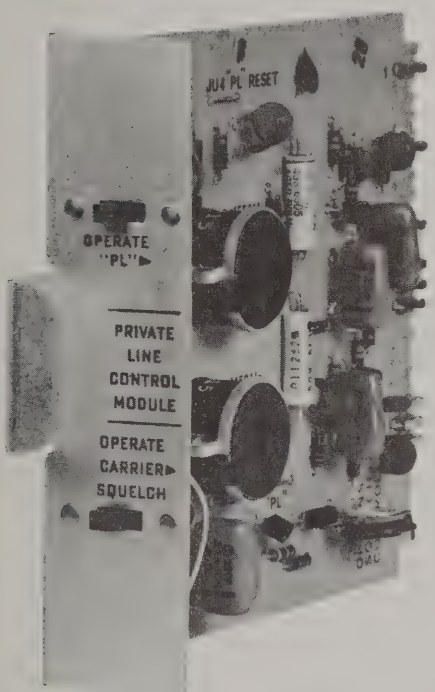
	1V80702B24	PANEL ASSEMBLY (riveted)
	45B83914G01	GUIDE, card: 2 used
	3S8022	SCREW, machine: #4-40 x 1/4": 2 used
	4S7683	LOCKWASHER: #4 Int.

TLN4151A Relay Kit PL-455-O

K1	80C84201A01	RELAY, armature: 2 form "C", coil res. 200 ohms

"PRIVATE-LINE" CONTROL MODULE

MODEL TLN1251A



1. DESCRIPTION

The TLN1251A "Private-Line" Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module provides selection of "Private-Line" tone-coded squelch or carrier squelch operation of the receiver, by tone command from a remote control point. A 1550 Hertz tone selects "Private-Line" operation, while a 1450 Hertz tone selects carrier squelch operation of the receiver.

3. CIRCUIT DESCRIPTION

A 1550 Hz tone entering the module on pin 11 is amplified and clipped in the Function Tone Amplifier stage Q1. After processing, the tone will pass through the tuned circuit L1-C4 into the operate PL detector stage Q2. Upon detection, the operate PL bistable multivibrator Q3-Q4 is turned on. When the bistable multivibrator is actuated, the collector of Q4 goes to ground, generating a negative-going pulse.

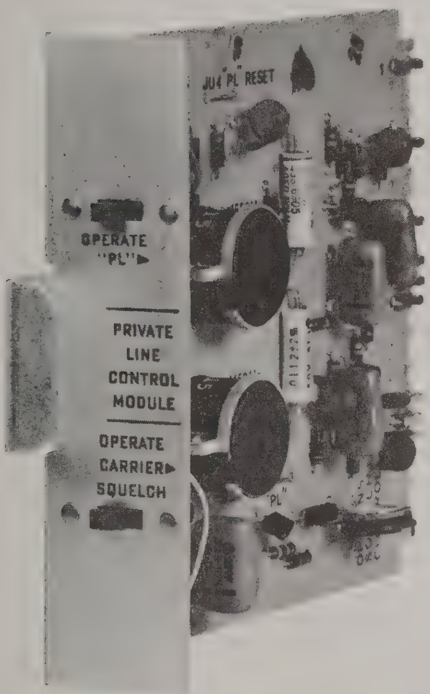
The negative-going pulse is applied to the operate carrier squelch bistable multivibrator Q6-Q7 through the diode CR5. This pulse causes the Q6-Q7 bistable multivibrator to change from its saturated state to its cutoff state. Upon deactivation, the Q7 collector, which was at ground potential, rises to approximately 11 volts. While the Q7 collector was at ground, pin 20 was grounded through diode CR7, causing the external PL disable circuitry to be activated. When the ground is removed, the "Private-Line" circuitry is no longer disabled, and "Private-Line" operation becomes functional.

A 1450 Hz tone entering the module on pin 11 is amplified and clipped in the Function Tone Amplifier stage Q1. After processing, the tone can pass into the tuned circuit L2-C10 and then into the operate carrier squelch detector stage Q5. Detection of the tone in this stage causes the operate carrier squelch bistable multivibrator Q6-Q7 to become actuated. When the bistable

MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

"PRIVATE-LINE" CONTROL MODULE

MODEL TLN1251A



1. DESCRIPTION

The TLN1251A "Private-Line" Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module provides selection of "Private-Line" tone-coded squelch or carrier squelch operation of the receiver, by tone command from a remote control point. A 1550 Hertz tone selects "Private-Line" operation, while a 1450 Hertz tone selects carrier squelch operation of the receiver.

3. CIRCUIT DESCRIPTION

A 1550 Hz tone entering the module on pin 11 is amplified and clipped in the Function Tone Amplifier stage Q1. After processing, the tone will pass through the tuned circuit L1-C4 into the operate PL detector stage Q2. Upon detection, the operate PL bistable multivibrator Q3-Q4 is turned on. When the bistable multivibrator is actuated, the collector of Q4 goes to ground, generating a negative-going pulse.

The negative-going pulse is applied to the operate carrier squelch bistable multivibrator Q6-Q7 through the diode CR5. This pulse causes the Q6-Q7 bistable multivibrator to change from its saturated state to its cutoff state. Upon deactivation, the Q7 collector, which was at ground potential, rises to approximately 11 volts. While the Q7 collector was at ground, pin 20 was grounded through diode CR7, causing the external PL disable circuitry to be activated. When the ground is removed, the "Private-Line" circuitry is no longer disabled, and "Private-Line" operation becomes functional.

A 1450 Hz tone entering the module on pin 11 is amplified and clipped in the Function Tone Amplifier stage Q1. After processing, the tone can pass into the tuned circuit L2-C10 and then into the operate carrier squelch detector stage Q5. Detection of the tone in this stage causes the operate carrier squelch bistable multivibrator Q6-Q7 to become actuated. When the bistable

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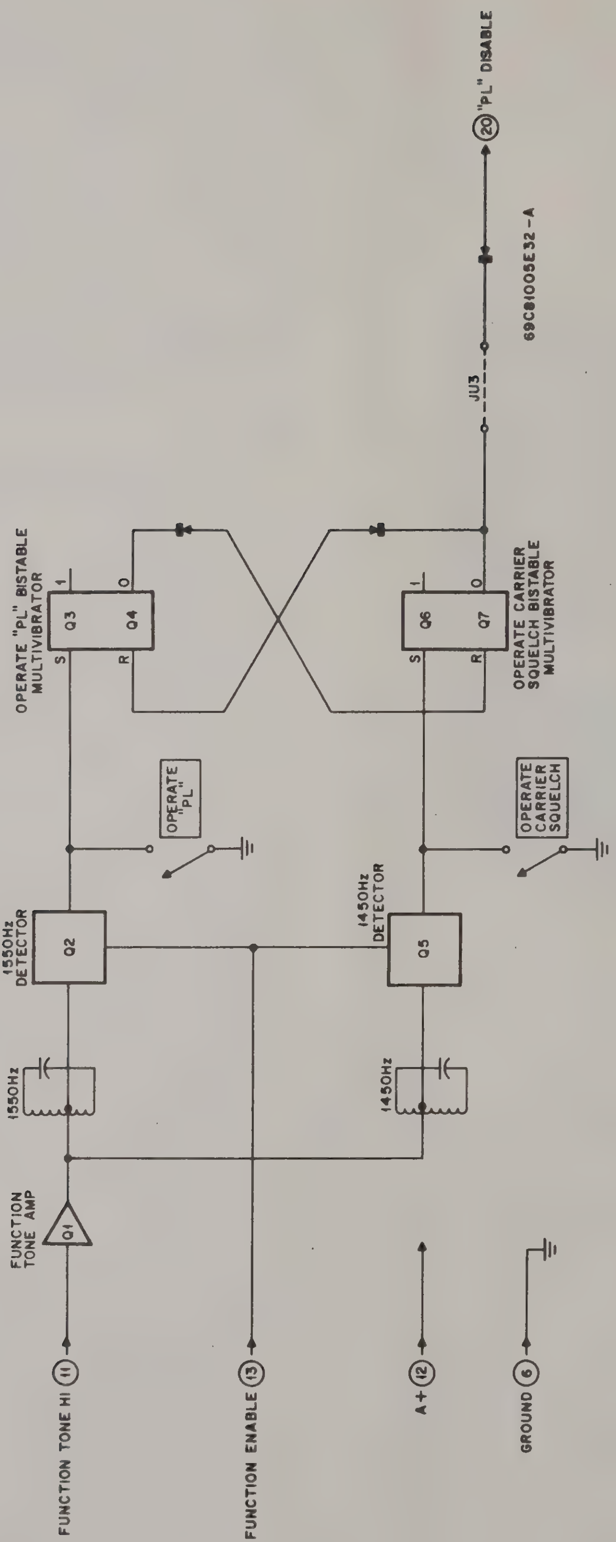


Functional Block Diagram

multivibrator changes state, the collector of Q7 goes to ground, and applies a ground to pin 20. This ground is normally applied to the external "Private-Line" disabling circuitry which reverts the equipment to carrier squelch operation.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired function is performed, then the module is functioning properly. If the function does not perform, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A PC Service Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 13	Ground
11	Oscillator Input
12	A+ 13.6 volts dc
20	10K ohms to 12

c. Module Malfunction Location Techniques

(1) Operate "Private-Line" Tone-Coded Squelch Stages

(a) Connect a dc voltmeter from the collector of Q4 to ground.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q2. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1550 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage Q2, then the multivibrator stage Q3-Q4. If the change of state occurs, look to the function tone amplifier for a malfunction.

(2) Operate Carrier Squelch Stages

(a) Connect a dc voltmeter from the collector of Q7 to ground.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of transistor Q5. The output level from the oscillator must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1450 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage Q5, then the multivibrator stage Q6-Q7. If the change of state occurs, look to the function tone amplifier for a malfunction.

REVISIONS

63P81005E12-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4050A	R6	WAS 6S131526, 18K	L1 TAP
	R9	WERE 6S131275, 220	Q2 EMITTER
	R20		Q5 EMITTER
	R10	WERE 6S129804, 2.2K	Q2 EMITTER
	R21		Q5 EMITTER
	R18	WAS 6S129236, 15K	L2 TAP
TLN4050A-1	C7, 8, 13, 14	WERE 8D82905G02, .022 uF	BASE OF Q3, Q4, Q6, Q7
TLN4050A-2			

PARTS LIST

TLN4050A Control Board — PL-431-B

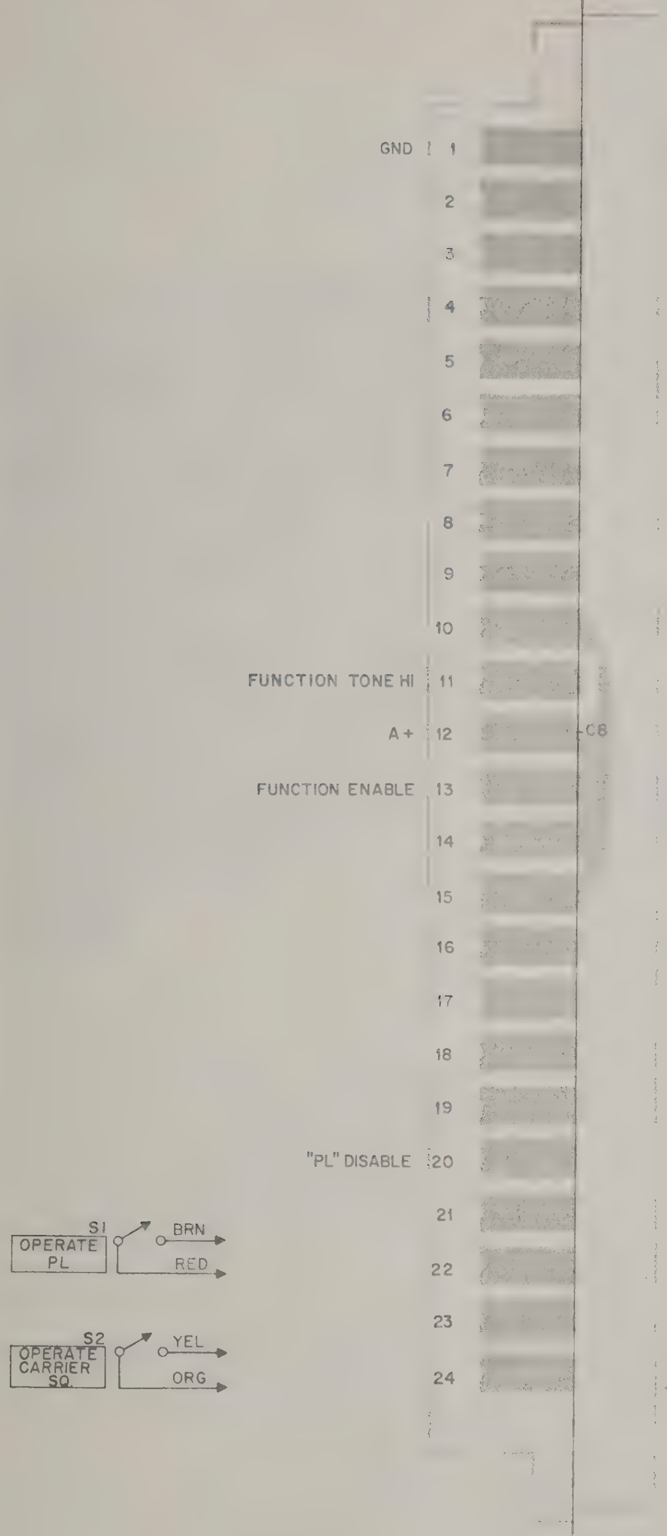
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 3, 6, 7, 8, 12, 13, 14, 16	8D82905G11	0.22 uF ±10%; 50 V
C2, 5, 11, 15, 17	21D82187B29	.001 uF +10%; 100 V
C4	8D84326A18	.0098 uF ±2%; 50 V
C9	23K865136	15 uF ±20%; 25 V
C10	8D84326A19	.0112 uF ±2%; 50 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 7	48C82392B03	silicon
		REACTOR:
L1, 2	1V80702B11	AF bandpass; (preset at factory); res 140 ohms ±10%; incl. grounding clip
		TRANSISTOR: (SEE NOTE)
Q1, 2, 4, 5, 7, 8, 9	48R869570	N-P-N; type M9570
Q3, 6	48R869571	P-N-P; type M9571
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R1, 12, 13, 15, 24, 25, 27	6S129620	560
R2	6S129886	27K ±5%
R3	6S129299	68K ±5%
R4, 8, 19	6S129805	1K ±5%
R5	6S124A09	22 ±5%
R6	6S129236	15K ±5%
R7, 11, 22, 23	6S128689	2.2K
R9, 20	6D84444A07	221 ±1%
R10, 21	6D84444A08	2.21K ±1%
R14, 26, 28	6S127804	4.7K
R16, 32	6S127805	15K
R17	6S129224	82
R18	6S129887	12K ±5%
R29	6S128902	47K
R30	6S129433	5.6K
R31	18C83083G03	var: 25K ±30%
R33	6S129231	3.3K
R34	6S127806	27K
R35	6S129145	82K
R36	6S129981	3.3K

TLN4053A "PL" Control Panel — PL-434-O

		SWITCH, slide:
S1, 2	40B83468E01	spdt; spring return
NON-REFERENCED ITEM		
	45B83914G01	GUIDE RAIL (slide-mount for circuit board); 2 req'd

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



NOTES:

1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O

REVISIONS

63P81005E12-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4050A	R6	WAS 6S131526, 18K	L1 TAP
	R9	WERE 6S131275, 220	Q2 EMITTER
	R20		Q5 EMITTER
	R10	WERE 6S129804, 2.2K	Q2 EMITTER
	R21		Q5 EMITTER
	R18	WAS 6S129236, 15K	L2 TAP
TLN4050A-1	C7, 8, 13, 14	WERE 8D82905G02, .022 uF	BASE OF Q3, Q4, Q6, Q7
TLN4050A-2			

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN4050A Control Board — PL-431-B

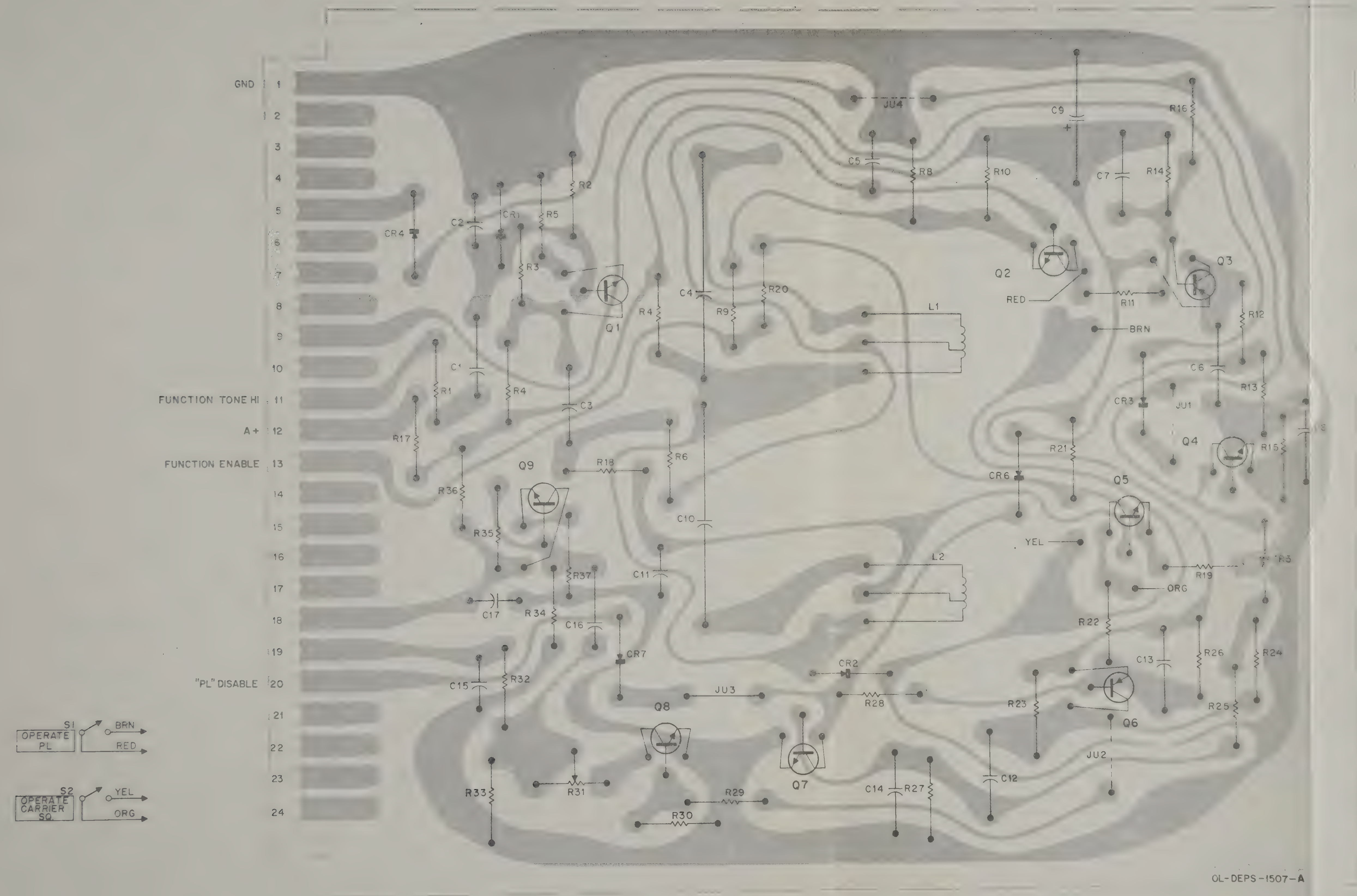
		CAPACITOR, fixed:
C1, 3, 6, 7, 8, 12, 13, 14, 16	8D82905G11	0.22 uF ±10%; 50 V
C2, 5, 11, 15, 17	21D82187B29	.001 uF +10%; 100. V
C4	8D84326A18	.0098 uF ±2%; 50 V
C9	23K865136	15 uF ±20%; 25 V
C10	8D84326A19	.0112 uF ±2%; 50 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 7	48C82392B03	silicon
		REACTOR:
L1, 2	1V80702B11	AF bandpass; (preset at factory); res 140 ohms ±10%; incl. grounding clip
		TRANSISTOR: (SEE NOTE)
Q1, 2, 4, 5, 7, 8, 9	48R869570	N-P-N; type M9570
Q3, 6	48R869571	P-N-P; type M9571
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R1, 12, 13, 15, 24, 25, 27	6S129620	560
R2	6S129886	27K ±5%
R3	6S129299	68K ±5%
R4, 8, 19	6S129805	1K ±5%
R5	6S124A09	22 ±5%
R6	6S129236	15K ±5%
R7, 11, 22, 23	6S128689	2.2K
R9, 20	6D84444A07	221 ±1%
R10, 21	6D84444A08	2.21K ±1%
R14, 26, 28	6S127804	4.7K
R16, 32	6S127805	15K
R17	6S129224	82
R18	6S129887	12K ±5%
R29	6S128902	47K
R30	6S129433	5.6K
R31	18C83083G03	var: 25K ±30%
R33	6S129231	3.3K
R34	6S127806	27K
R35	6S129145	82K
R36	6S129981	3.3K

TLN4053A "PL" Control Panel — PL-434-O

		SWITCH, slide:
S1, 2	40B83468E01	spdt; spring return
NON-REFERENCED ITEM		
	45B83914G01	GUIDE RAIL (slide-mount for circuit board); 2 req'd

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

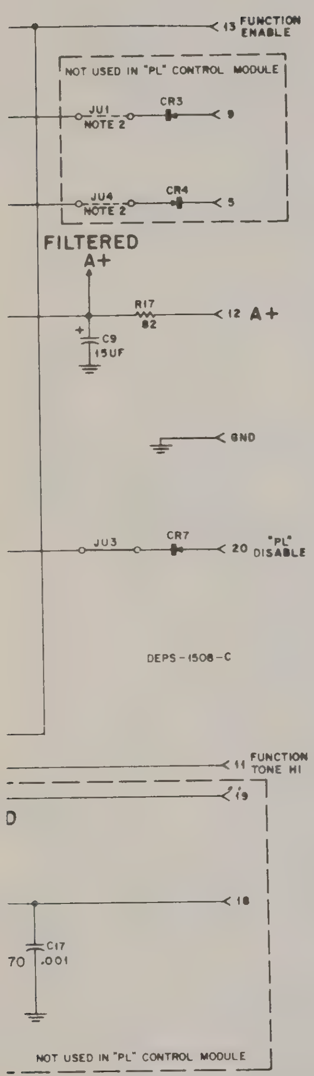


OL-DEPS-1507-A

NOTES:

1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O



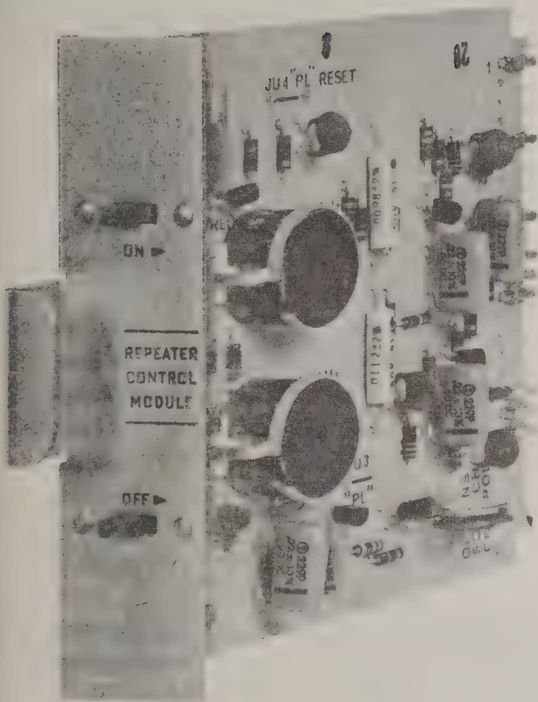
"PRIVATE-LINE" CONTROL MODULE

ɪS REVISIONS AND PARTS LIST
ɔN BACK OF THIS DIAGRAM

c Diagram
uit Board Detail
No. 63P81005E12-C
UP

REPEATER CONTROL MODULE

MODEL TLN1250A



1. DESCRIPTION

The TLN1250A Repeater Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module provides functions to control the turning on or off of repeater operation. A 1450-Hz tone command originating from a remote control point activates circuitry on the module to cause the repeater operation to be activated ("set up"); a 1550-Hz tone command causes the repeater operation to be deactivated ("turnoff").

3. CIRCUIT DESCRIPTION

A 1550-Hz tone entering the module on pin 11 is amplified and clipped in the amplifier stage (Q1). From the Q1 stage, the tone passes through the tuned circuit (L1-C4) and into the Q2 stage, where it is detected. Upon detection, the Repeater Turnoff Bistable Multivibrator (Q3-Q4) is triggered, applying a ground to pin 9.

When the bistable multivibrator (Q3-Q4) is triggered, the negative-going pulse generated is applied through diode CR5 to the Repeater Setup Bistable Multivibrator (Q6-Q7), causing it to turn off so that the repeater function cannot be turned on.

When a 1450-Hz tone is applied to the module from a remote control point, it passes through the function tone amplifier stage (Q1) as before, but it can only enter the tuned circuit (L2-C10) which is resonant at 1450 Hz. Passing through the tuned circuit, the tone is detected in the detector stage (Q5) which causes the Repeater Setup Bistable Multivibrator to change state. When the change occurs, the collector of Q7 goes to ground potential. As this occurs, a negative pulse is coupled through diode CR6 to the Repeater Turnoff Bistable Multibivator (Q3-Q4). The multivibrator is forced to return to its off state. When the multivibrator returns to its off state, the ground is removed from pin 9 of the module, allowing the repeater operation to function once again.

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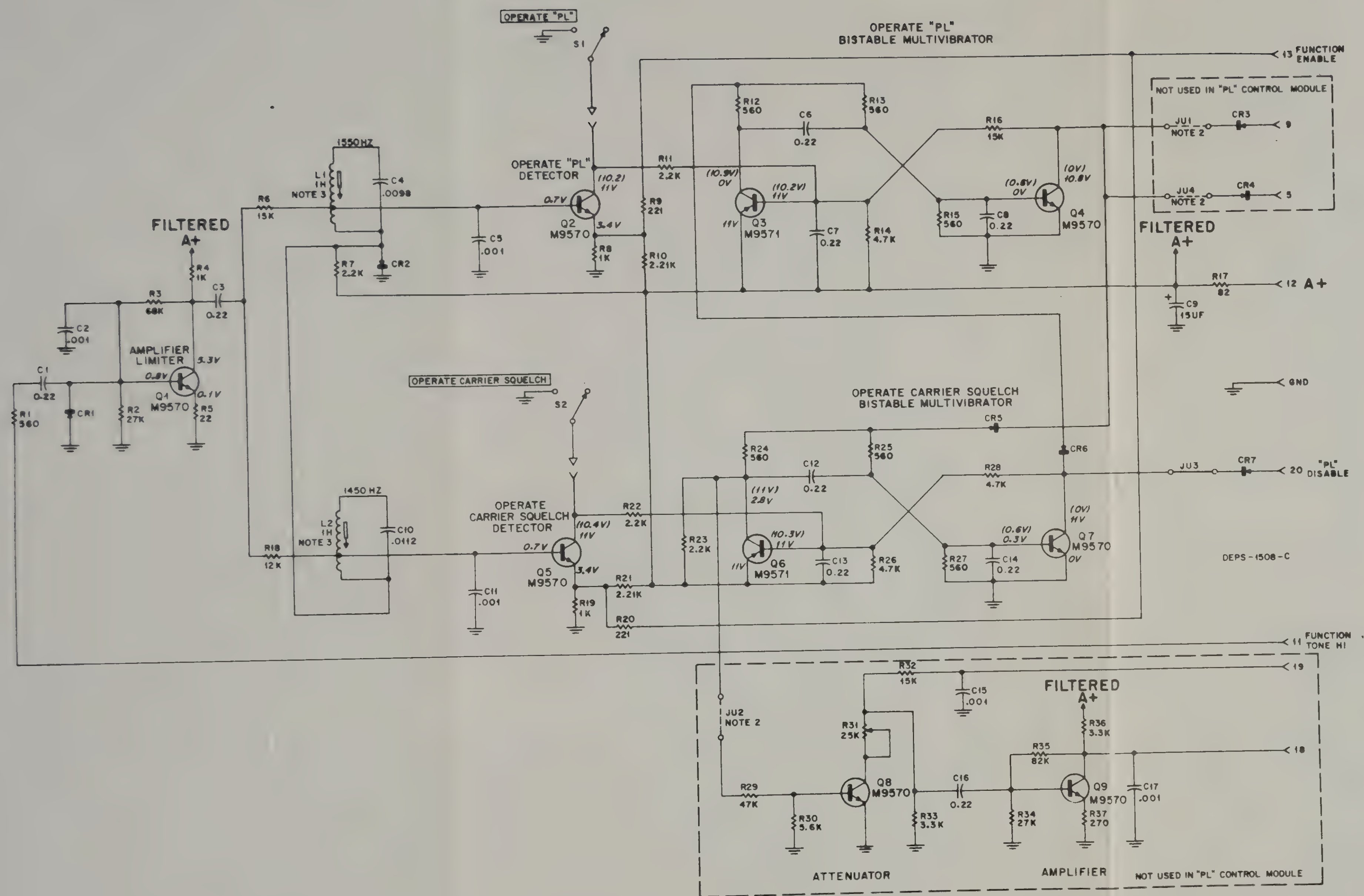


"PRIVATE-LINE" CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Schematic Diagram
And Circuit Board Detail
Motorola No. 63P81005E12-C
4/30/71-UP

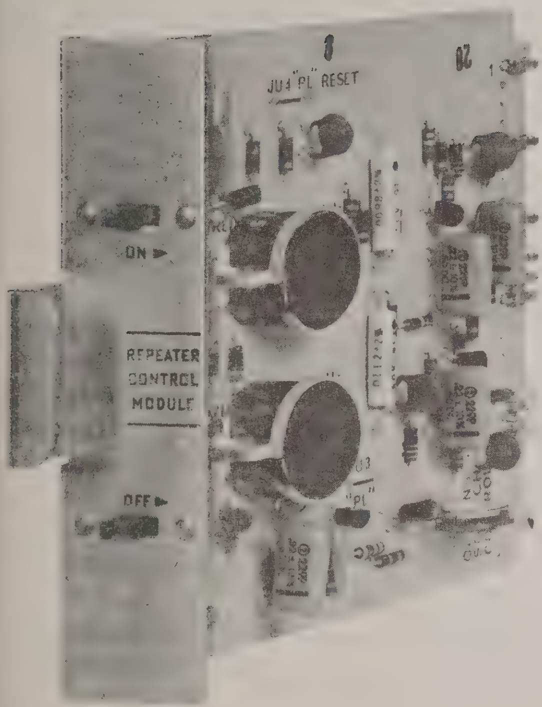
NOTES:

1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O

REPEATER CONTROL MODULE

MODEL TLN1250A



1. DESCRIPTION

The TLN1250A Repeater Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module provides functions to control the turning on or off of repeater operation. A 1450-Hz tone command originating from a remote control point activates circuitry on the module to cause the repeater operation to be activated ("set up"); a 1550-Hz tone command causes the repeater operation to be deactivated ("turnoff").

3. CIRCUIT DESCRIPTION

A 1550-Hz tone entering the module on pin 11 is amplified and clipped in the amplifier stage (Q1). From the Q1 stage, the tone passes through the tuned circuit (L1-C4) and into the Q2 stage, where it is detected. Upon detection, the Repeater Turnoff Bistable Multivibrator (Q3-Q4) is triggered, applying a ground to pin 9.

When the bistable multivibrator (Q3-Q4) is triggered, the negative-going pulse generated is applied through diode CR5 to the Repeater Setup Bistable Multivibrator (Q6-Q7), causing it to turn off so that the repeater function cannot be turned on.

When a 1450-Hz tone is applied to the module from a remote control point, it passes through the function tone amplifier stage (Q1) as before, but it can only enter the tuned circuit (L2-C10) which is resonant at 1450 Hz. Passing through the tuned circuit, the tone is detected in the detector stage (Q5) which causes the Repeater Setup Bistable Multivibrator to change state. When the change occurs, the collector of Q7 goes to ground potential. As this occurs, a negative pulse is coupled through diode CR6 to the Repeater Turnoff Bistable Multibivator (Q3-Q4). The multivibrator is forced to return to its off state. When the multivibrator returns to its off state, the ground is removed from pin 9 of the module, allowing the repeater operation to function once again.

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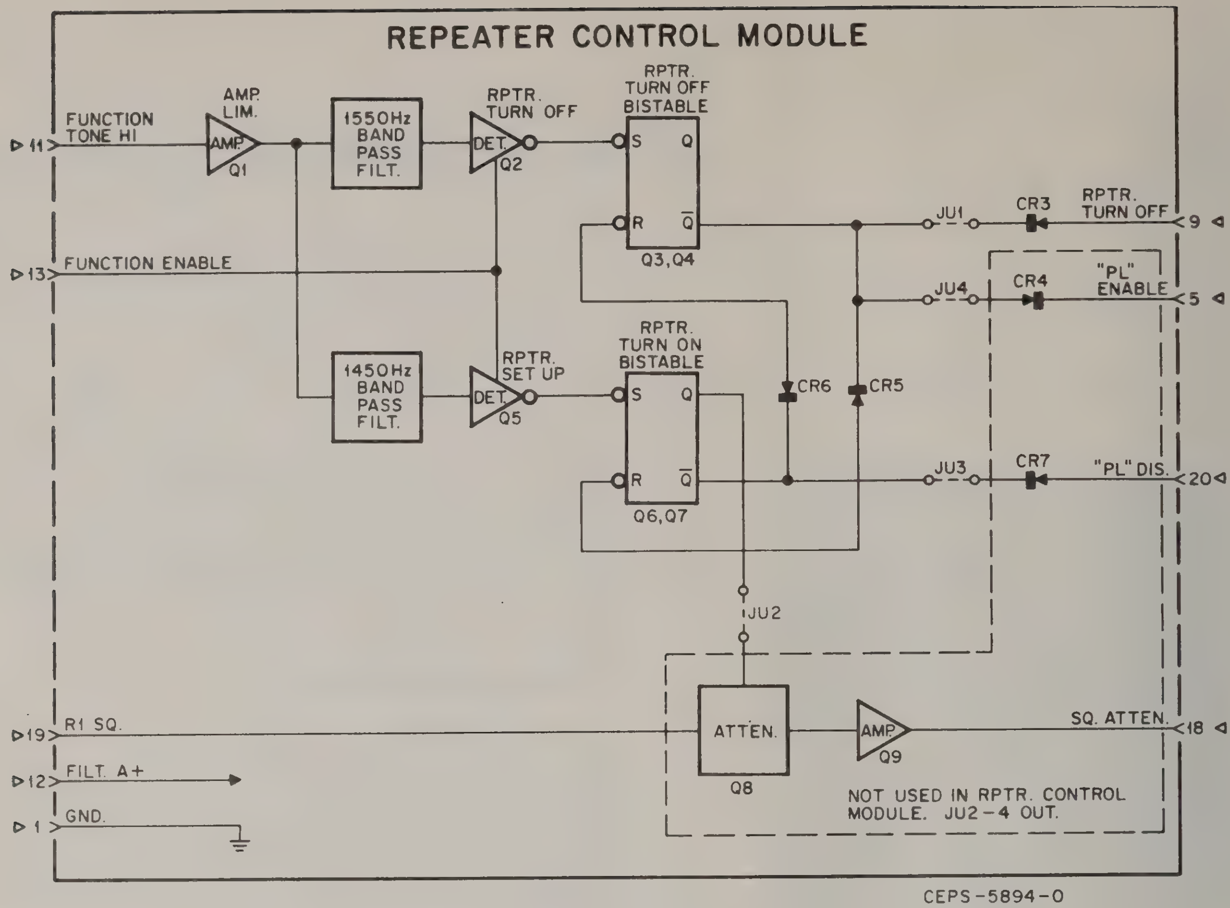


Functional Block Diagram

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired function is performed, then the module is functioning properly. If the function does not perform, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A Module Extension Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 13	Ground
9	10 kilohms to pin 12
11	Oscillator input
12	A+; 13.6 volts dc

c. Module Malfunction Location Techniques

(1) Operate Repeater Turnoff Stages

(a) Connect a dc voltmeter from the collector of Q4 to ground.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q2. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1550 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage (Q2) then the multivibrator stage (Q3-Q4). If the change of state occurs, look to the function tone amplifier for a malfunction.

(2) Operate Repeater Setup Stages

(a) Connect a dc voltmeter from the collector of Q9 to ground.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of transistor Q5. The output level from the oscillator must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1450 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage (Q5) then the multivibrator stage (Q6-Q7). If the change of state occurs, look to the function tone amplifier for a malfunction.

REVISIONS

63P81005E04-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4050A	R6	WAS 6S131526, 18K	L1 TAP
	R9	WERE 6S131275, 220	Q2 EMITTER
	R20		Q5 EMITTER
	R10	WERE 6S129804, 2.2K	Q2 EMITTER
	R21		Q5 EMITTER
	R18	WAS 6S129236, 15K	L2 TAP
TLN4050A-1	C7, 8, 13, 14	WERE 8D82905G02 .022 uF	BASE OF Q3, Q4, Q6, Q7
TLN4050A-2			

PARTS LIST

TLN4050A Control Board PL-431-B

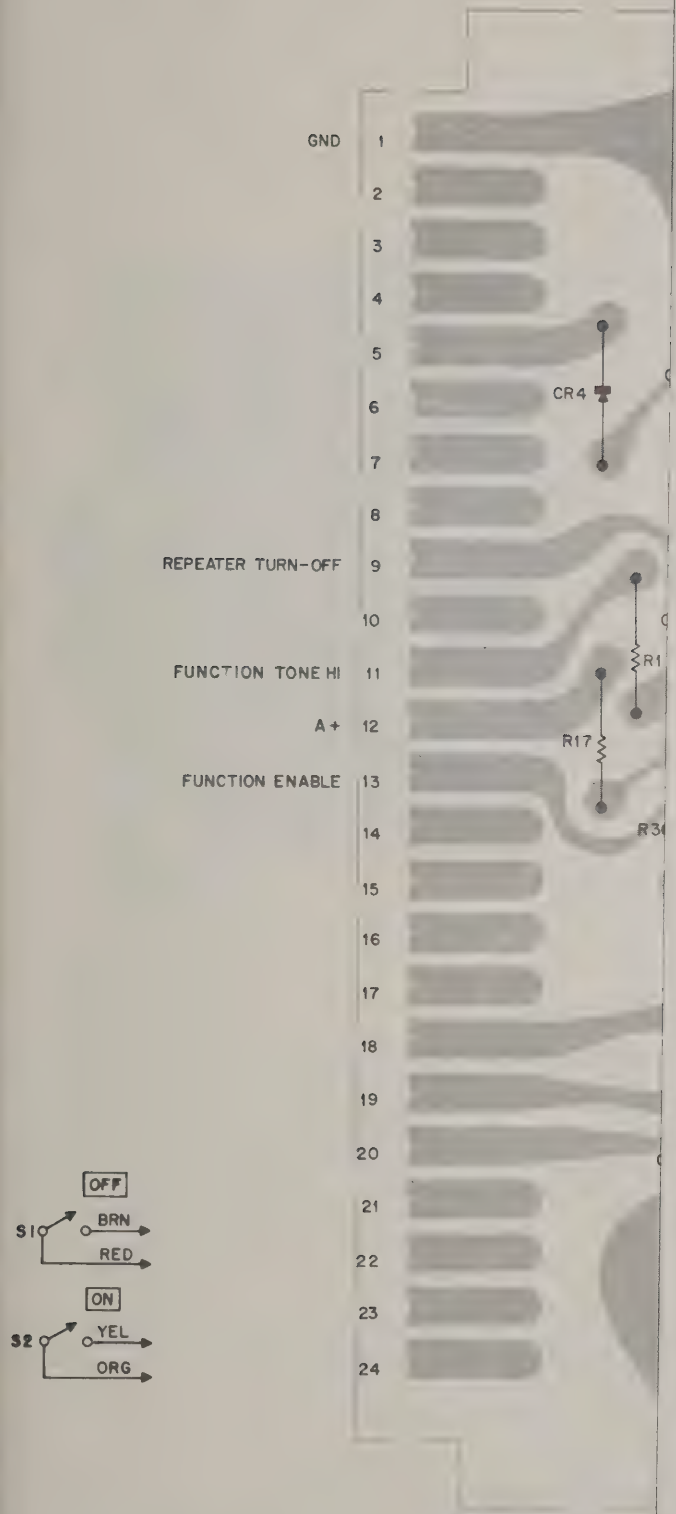
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 3, 6, 7, 8, 12, 13, 14, 16	8D82905G11	0.22 uF ±10%; 50 V
C2, 5, 11, 15, 17	21D82187B29	.001 uF +10%; 100 V
C4	8D84326A18	.0098 uF ±2%; 50 V
C9	23K865136	15 uF ±20%; 25 V
C10	8D84326A19	.0112 uF ±2%; 50 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 7	48C82392B03	silicon
		REACTOR:
L1, 2	1V80702B11	AF bandpass; (preset at factory); res 140 ohms ±10%; incl. grounding clip
		TRANSISTOR: (SEE NOTE)
Q1, 2, 4, 5, 7, 8, 9	48R869570	N-P-N; type M9570
Q3, 6	48R869571	P-N-P; type M9571
		RESISTOR, fixed. ±10%; 1/4 W; unl. stated
R1, 12, 13, 15, 24, 25, 27	6S129620	560
R2	6S129886	27K ±5%
R3	6S129299	68K ±5%
R4, 8, 19	6S129805	1K ±5%
R5	6S124A09	22 ±5%
R6	6S129236	15K ±5%
R7, 11, 22, 23	6S128689	2.2K
R9, 20	6D84444A07	221 ±1%
R10, 21	6D84444A08	2.21K ±1%
R14, 26, 28	6S127804	4.7K
R16, 32	6S127805	15K
R17	6S129224	82
R18	6S129887	12K ±5%
R29	6S128902	47K
R30	6S129433	5.6K
R31	18C83083G03	var 25K ±30%
R33	6S129231	3.3K
R34	6S127806	27K
R35	6S129145	82K
R36	6S129981	3.3K

TLN4052A Repeater Control Panel PL-433-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH, slide:
S1, 2	40B83468E01	spdt; spring return
	NON-REFERENCED ITEM	
	45B83914G01	GUIDE RAIL (slide-mount for circuit board): 2 req'd.

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



NOTES:

1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O

REVISIONS

63P81005E04-C

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4050A	R6	WAS 6S131526, 18K	L1 TAP
	R9	WERE 6S131275, 220	Q2 EMITTER
	R20		Q5 EMITTER
	R10	WERE 6S129804, 2.2K	Q2 EMITTER
	R21		Q5 EMITTER
	R18	WAS 6S129236, 15K	L2 TAP
TLN4050A-1	C7, 8, 13, 14	WERE 8D82905G02 .022 uF	BASE OF Q3, Q4, Q6, Q7
TLN4050A-2			

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN4050A Control Board PL-431-B

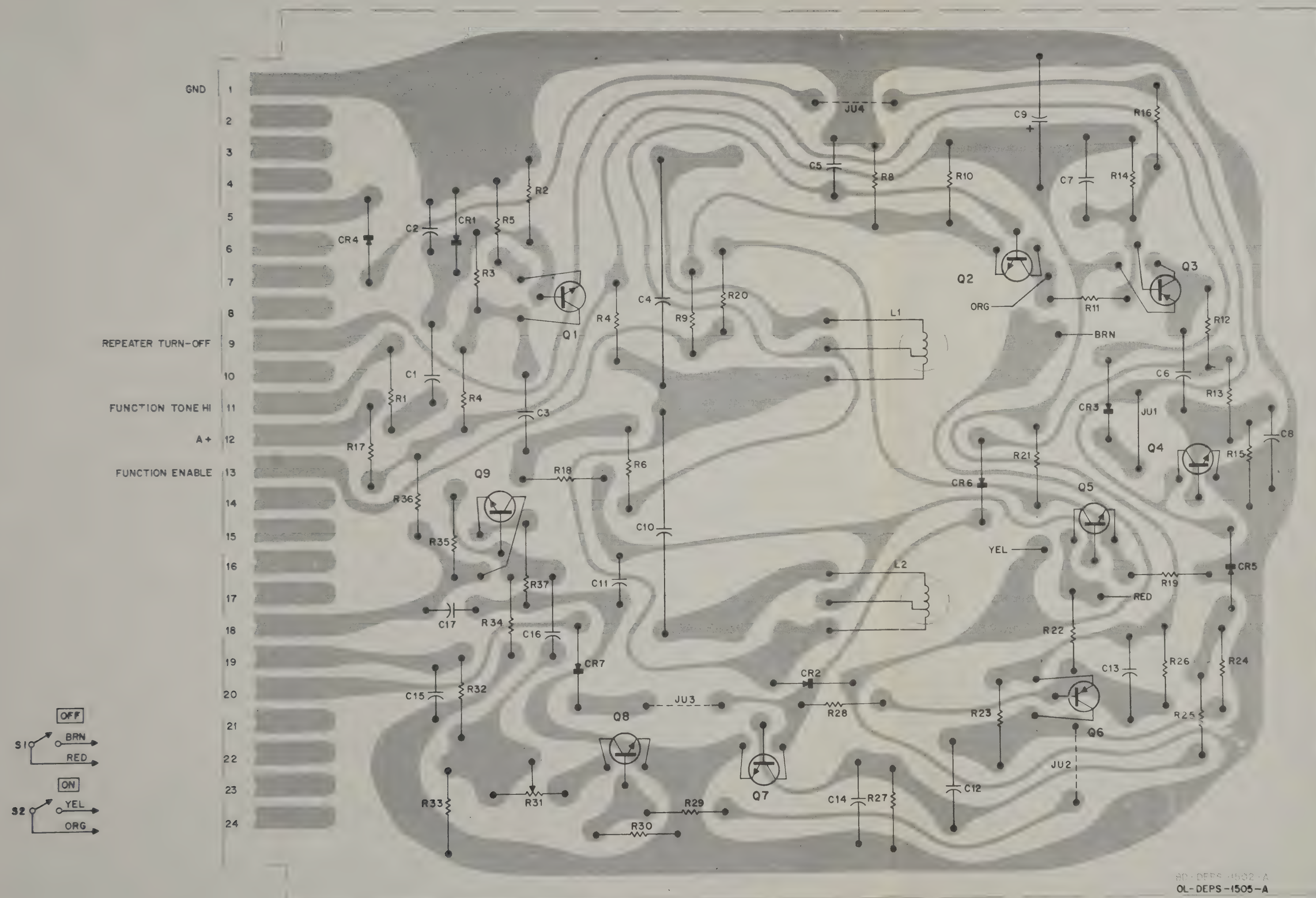
		CAPACITOR, fixed:
C1, 3, 6; 7, 8, 12, 13, 14, 16	8D82905G11	0.22 uF ±10%; 50 V
C2, 5, 11, 15, 17	21D82187B29	.001 uF +10%; 100 V
C4	8D84326A18	.0098 uF ±2%; 50 V
C9	23K865136	15 uF ±20%; 25 V
C10	8D84326A19	.0112 uF ±2%; 50 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 7	48C82392B03	silicon
		REACTOR:
L1, 2	1V80702B11	AF bandpass; (preset at factory); res 140 ohms ±10%; incl. grounding clip
		TRANSISTOR: (SEE NOTE)
Q1, 2, 4, 5, 7, 8, 9	48R869570	N-P-N; type M9570
Q3, 6	48R869571	P-N-P; type M9571
		RESISTOR, fixed. ±10%; 1/4 W; unl. stated
R1, 12, 13, 15, 24, 25, 27	6S129620	560
R2	6S129886	27K ±5%
3	6S129299	68K ±5%
4, 8, 19	6S129805	1K ±5%
R5	6S124A09	22 ±5%
R6	6S129236	15K ±5%
R7, 11, 22, 23	6S128689	2.2K
R9, 20	6D84444A07	221 ±1%
10, 21	6D84444A08	2.21K ±1%
R14, 26, 28	6S127804	4.7K
R16, 32	6S127805	15K
R17	6S129224	82
R18	6S129887	12K ±5%
R29	6S128902	47K
30	6S129433	5.6K
R31	18C83083G03	var 25K ±30%
R33	6S129231	3.3K
R34	6S127806	27K
R35	6S129145	82K
R36	6S129981	3.3K

TLN4052A Repeater Control Panel PL-433-O

S1, 2	40B83468E01	SWITCH, slide: spdt; spring return
	NON-REFERENCED ITEM	
	45B83914G01	GUIDE RAIL (slide-mount for circuit board): 2 req'd.

NOTE:

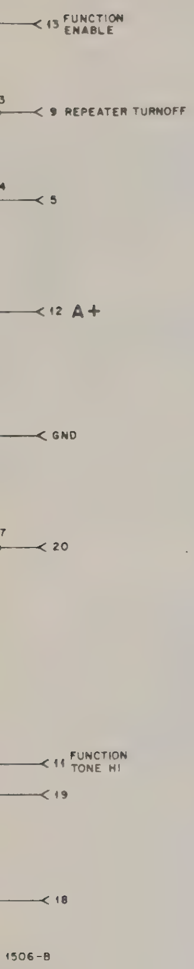
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



NOTES:

1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O



REPEATER CONTROL MODULE

VISIONS AND PARTS LIST
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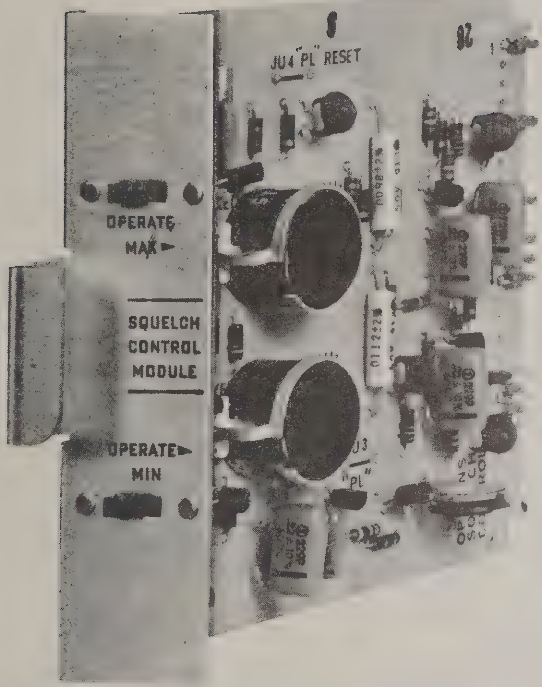
ram
ard Detail
3P81005E04-C

SQUELCH CONTROL MODULE

MODEL TLN1249A



1. DESCRIPTION

The TLN1249A Squelch Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module provides selection of squelch level on tone command from a remote control point. When the proper frequency tone command is detected in the module, the squelch level for the station receiver is set to threshold or to maximum, as determined by the input tone frequency. A 1450 Hz tone sets up threshold squelch while a 1550 Hz tone sets up maximum squelch.

3. CIRCUIT DESCRIPTION

A 1550 Hz tone applied to pin 11 is amplified and clipped in the Q1 amplifier stage. This tone will pass through the tuned circuit (L1-C4) and be detected in the Q2 tone detector stage. Detection of the tone causes the bistable multivibrator stage (Q3-Q4) to change state. This change of state causes the Operate Threshold Squelch Bistable Multivibrator (Q6-Q7) to shut off, and the attenuator transistor (Q8) to cut off. With cutoff, the transistor appears as an open circuit to the squelch control (R31). Noise entering pin 19 is attenuated through the 15K and 3.3K ohm resistors (R32 and R33), then amplified through transistor stage Q9. After amplification, the no-signal noise passes out pin 18 to the receiver noise squelch circuitry to activate a maximum squelch condition.

When a 1450 Hz tone is applied to pin 11, it is amplified and clipped in the Q1 amplifier stage as before. The tone will pass through the tuned circuit (L2-C10) and be detected in the Threshold Squelch Detector Stage (Q5). When the tone is detected, the threshold squelch bistable multivibrator (Q6-Q7) is turned on and turns off the maximum squelch bistable multivibrator stage (Q3-Q4) through diode CR6. When the threshold squelch bistable multivibrator is turned on, the base of the attenuator transistor (Q8) goes more positive, turning it on, which grounds the squelch

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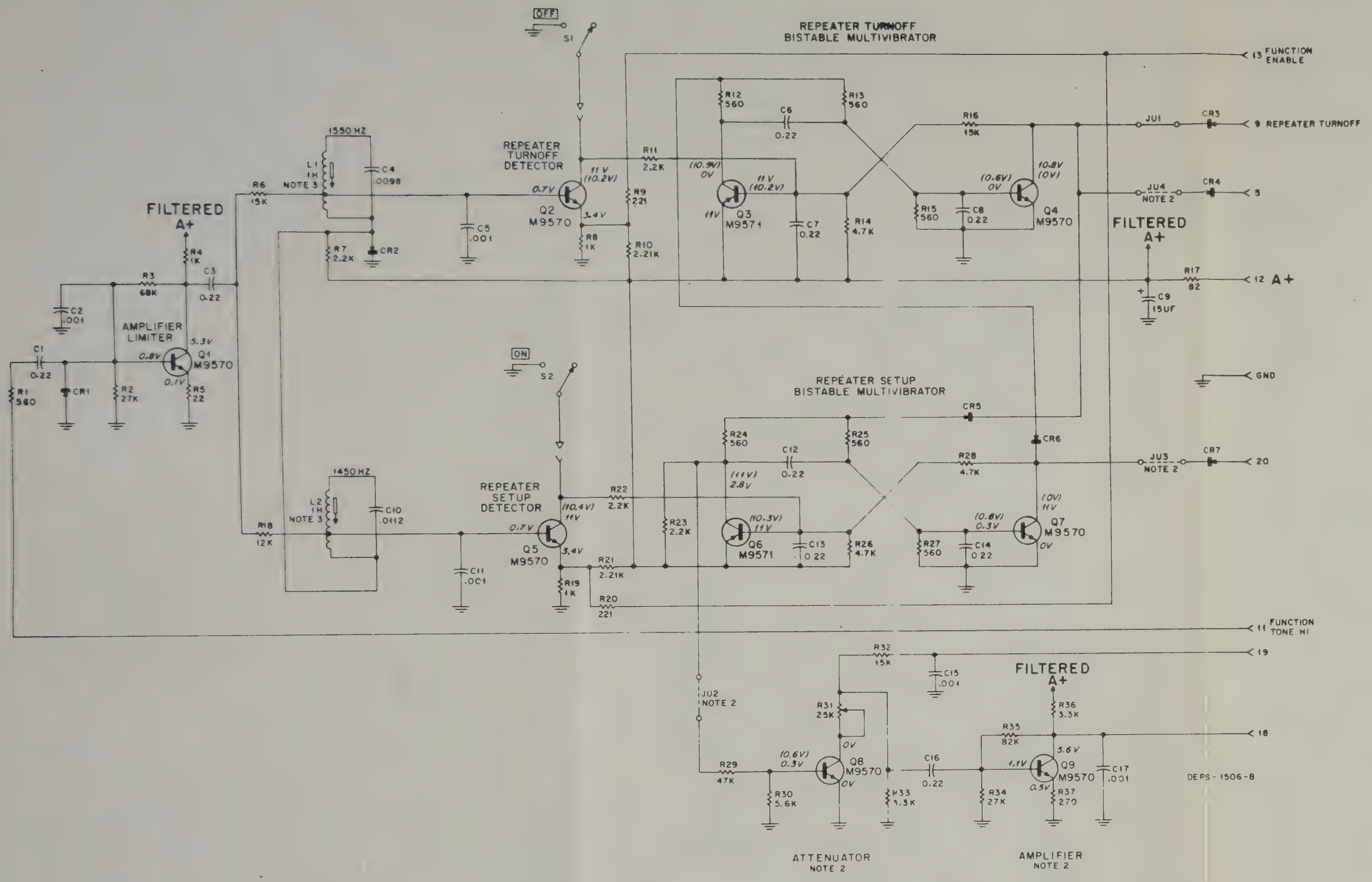


NOTES:

1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O

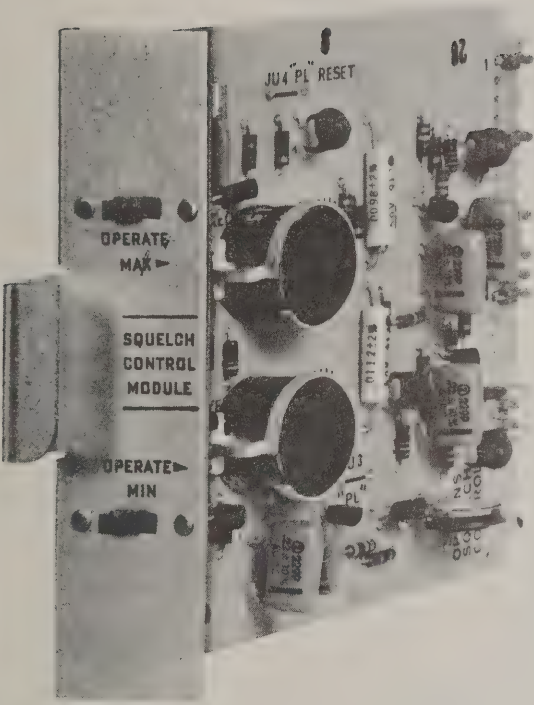
REPEATER CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Schematic Diagram
And Circuit Board Detail
Motorola No. 63P81005E04-C
3/1/72-UP

SQUELCH CONTROL MODULE

MODEL TLN1249A



1. DESCRIPTION

The TLN1249A Squelch Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

This module provides selection of squelch level on tone command from a remote control point. When the proper frequency tone command is detected in the module, the squelch level for the station receiver is set to threshold or to maximum, as determined by the input tone frequency. A 1450 Hz tone sets up threshold squelch while a 1550 Hz tone sets up maximum squelch.

3. CIRCUIT DESCRIPTION

A 1550 Hz tone applied to pin 11 is amplified and clipped in the Q1 amplifier stage. This tone will pass through the tuned circuit (L1-C4) and be detected in the Q2 tone detector stage. Detection of the tone causes the bistable multivibrator stage (Q3-Q4) to change state. This change of state causes the Operate Threshold Squelch Bistable Multivibrator (Q6-Q7) to shut off, and the attenuator transistor (Q8) to cut off. With cutoff, the transistor appears as an open circuit to the squelch control (R31). Noise entering pin 19 is attenuated through the 15K and 3.3K ohm resistors (R32 and R33), then amplified through transistor stage Q9. After amplification, the no-signal noise passes out pin 18 to the receiver noise squelch circuitry to activate a maximum squelch condition.

When a 1450 Hz tone is applied to pin 11, it is amplified and clipped in the Q1 amplifier stage as before. The tone will pass through the tuned circuit (L2-C10) and be detected in the Threshold Squelch Detector Stage (Q5). When the tone is detected, the threshold squelch bistable multivibrator (Q6-Q7) is turned on and turns off the maximum squelch bistable multivibrator stage (Q3-Q4) through diode CR6. When the threshold squelch bistable multivibrator is turned on, the base of the attenuator transistor (Q8) goes more positive, turning it on, which grounds the squelch

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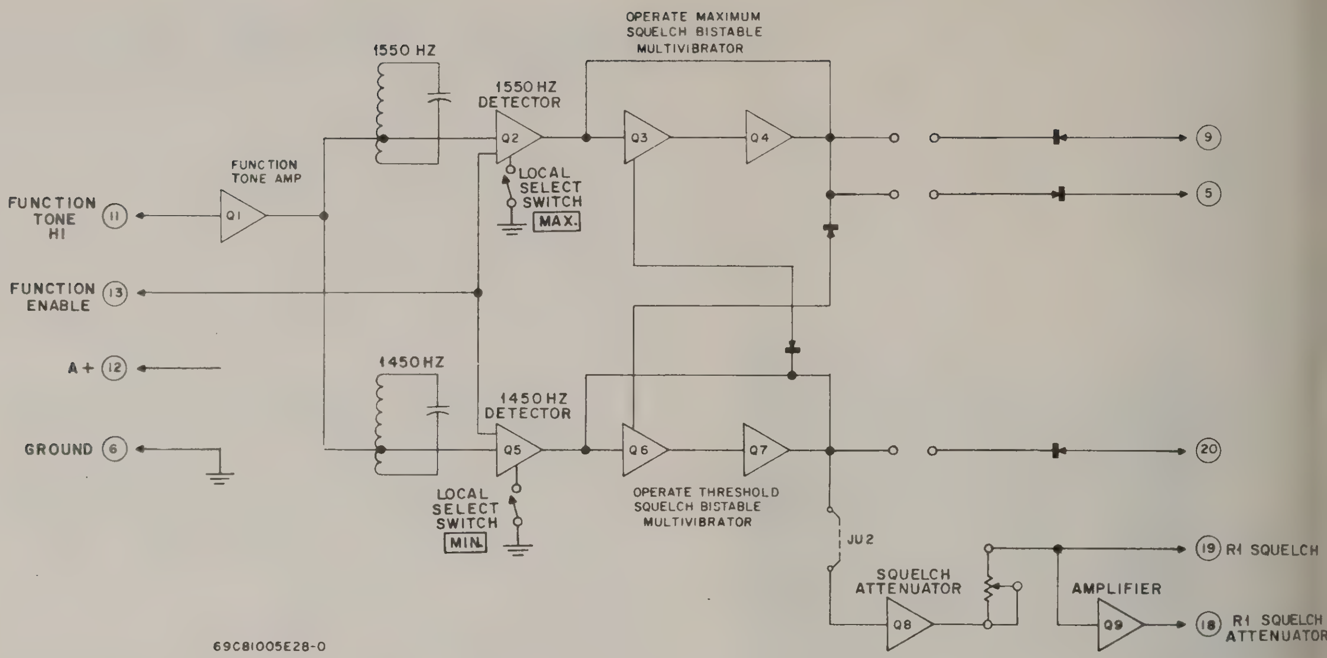


Functional Block Diagram

control potentiometer R31, allowing control of the noise level passing into the amplifier stage (Q9), where it is amplified before passing out of the circuit board on pin 18 to determine the threshold squelch level.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired function is performed, then the module is functioning properly. If the function does not perform, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module, insert a Model TLN8799A PC Service Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 13	Ground
11	Oscillator Input
12	A+ 13.6 volts dc
19	Oscillator input

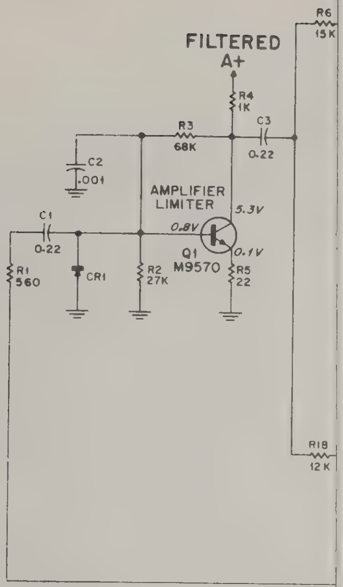
c. Module Malfunction Location Techniques

(1) Operate Maximum Squelch Stages

(a) Connect a dc voltmeter from the collector of Q4 to ground.

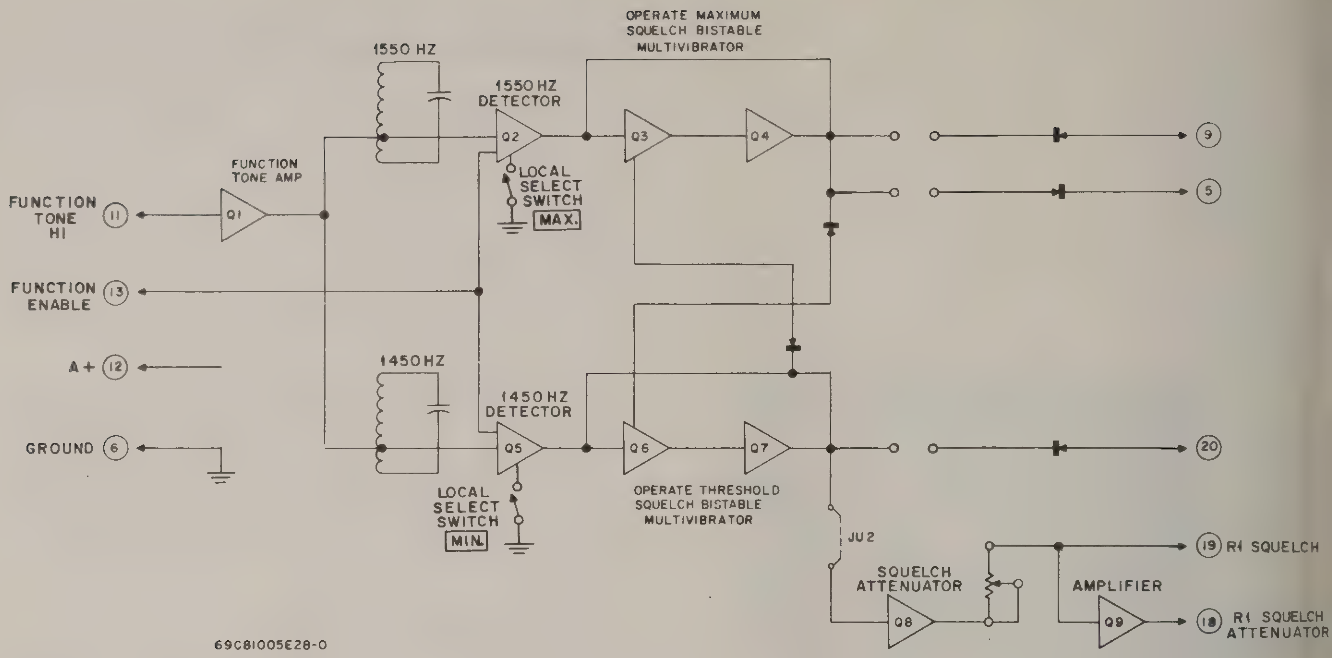
(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q2. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1550 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage (Q2), then the multivibrator stage (Q3-Q4). If the change of



NOTES:

1. VOLTAGES IN PARENTHESES ARE F
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED



Functional Block Diagram

control potentiometer R31, allowing control of the noise level passing into the amplifier stage (Q9), where it is amplified before passing out of the circuit board on pin 18 to determine the threshold squelch level.

4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be isolated to either the remote equipment or the remote control chassis. To determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired function is performed, then the module is functioning properly. If the function does not perform, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

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(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis, testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 13	Ground
11	Oscillator Input
12	A+ 13.6 volts dc
19	Oscillator input

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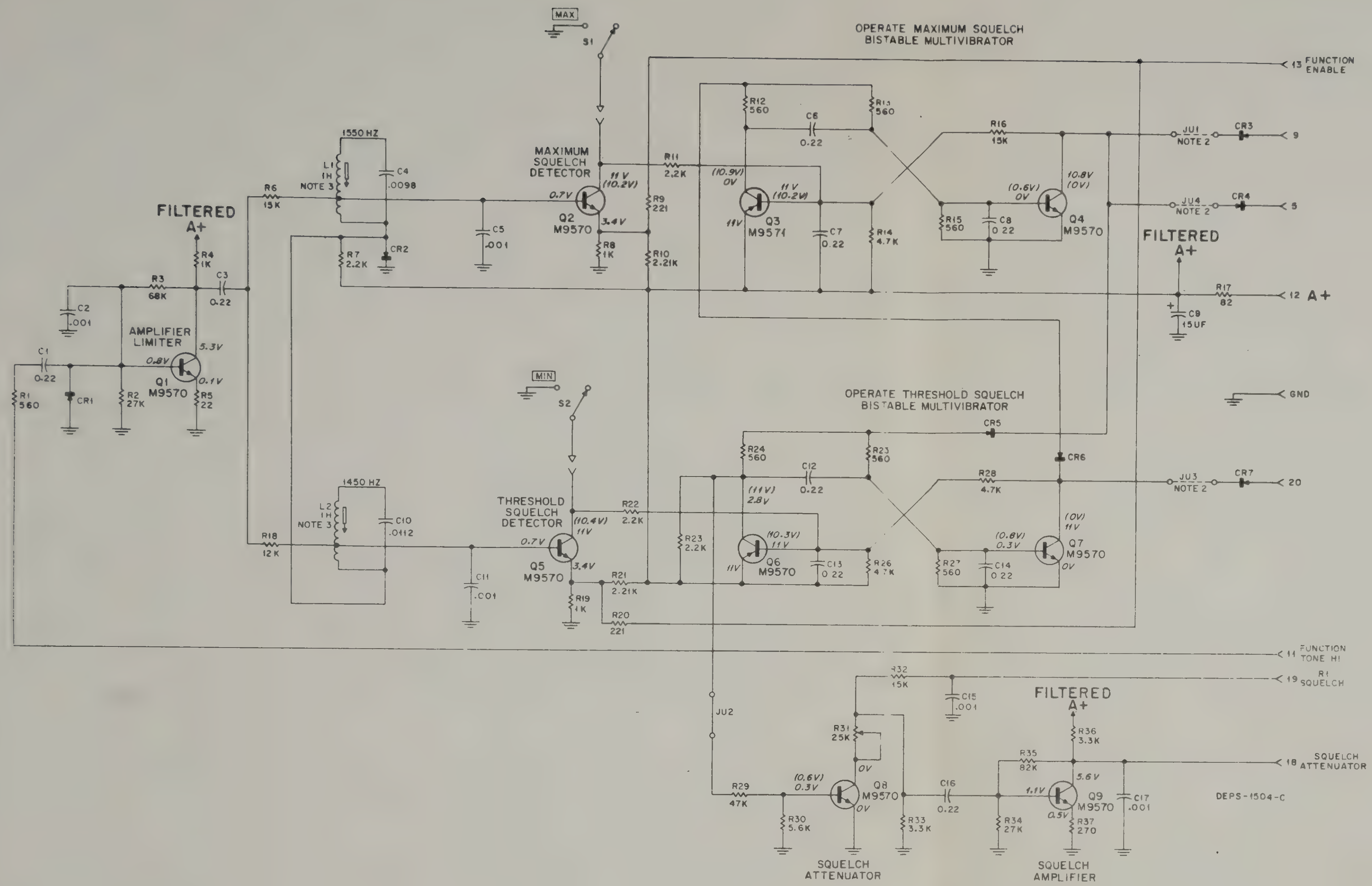
(1) Operate Maximum Squelch Stages

(a) Connect a dc voltmeter from the collector of Q4 to ground.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q2. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1550 Hz. The voltmeter reading should fall to zero volts, indicating that the multivibrator has changed state. If the change of state does not occur, check the detector stage (Q2), then the multivibrator stage (Q3-Q4). If the change of



NOTES:

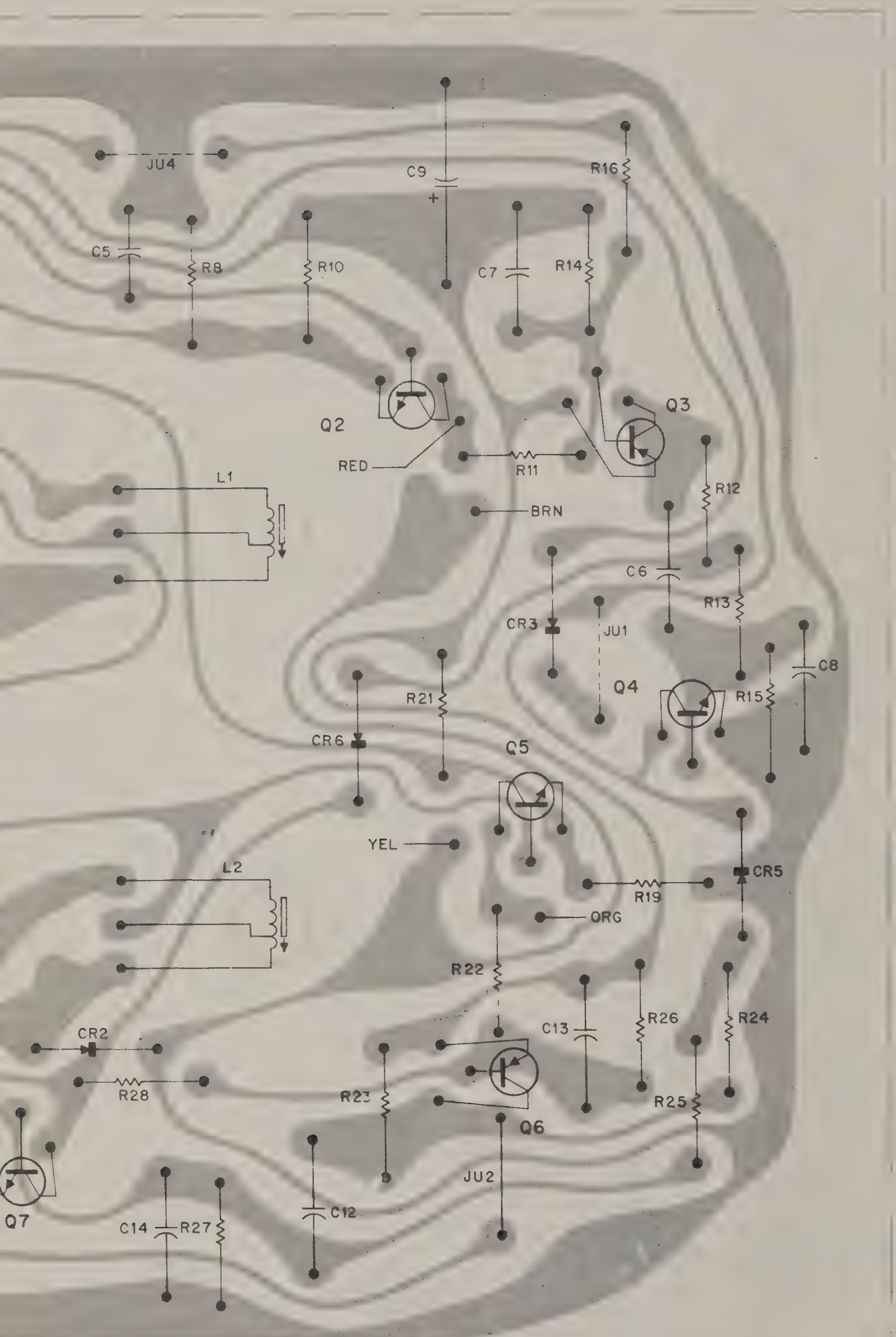
1. VOLTAGES IN PARENTHESES ARE FOR ACTIVATED STATE.
2. NOT USED IN THIS CIRCUIT.
3. FACTORY ADJUSTED TO REQUIRED FREQUENCY.

EPS-2086-O

SQUELCH CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

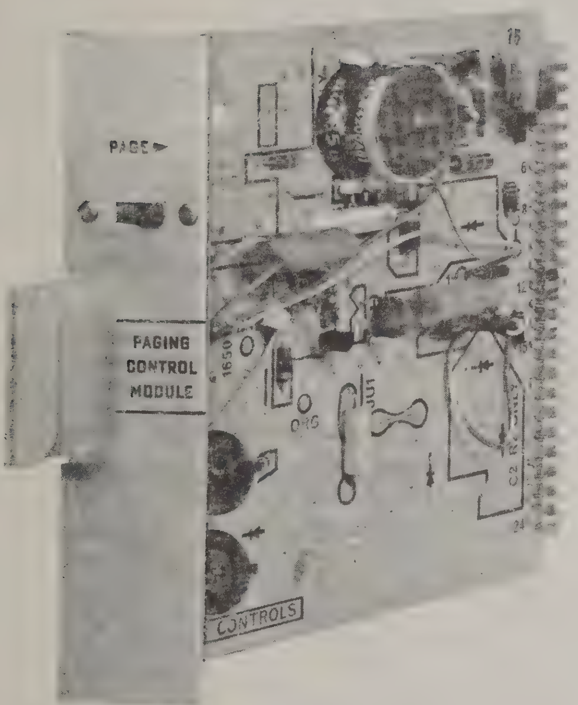
Schematic Diagram
And Circuit Board Detail
Motorola No. 63P81005E02-A
3/1/72-UP



BD-DEPS-1502-A
OL-DEPS-1503-B

PAGING CONTROL MODULE

MODEL TLN1253A



1. DESCRIPTION

The TLN1253A Paging Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

2. FUNCTIONS

Normal sub-audible "Private-Line" tone-coded transmission is permitted until the paging mode is selected. When the paging control module is selected, an 1850 Hz command tone is sent to the tone remote chassis, inhibiting the PL tone generator in the transmitter, and a non-PL carrier is transmitted. This carrier can be modulated by paging tones from a paging encoder located at the station. The page-tone-coded message would be heard only by non-PL receivers with the correct paging decoder. If the non-PL transmission is not modulated by paging tones, all non-PL receivers would hear the message.

3. CIRCUIT DESCRIPTION

With a ground applied to the function enable line, pin 13, and switched 8.8 volts present at pin 8, the detector stage Q1 is operational. An 1850-Hz tone entering the module on pin 11 is amplified and clipped in the amplifier stage Q4. With the detector stage operational, the detected tone triggers the Paging Bistable Multivibrator Q2-Q3. When the bistable multivibrator turns on, a ground is applied to pins 1B and 2B.

The ground on pin 1B is conveyed through diode CR1 and pin 10 to activate the T1 channel element bistable multivibrator on the associated F1 Control Module, turning on the transmitter. The same ground applied to pin 14 through pin 2B and diode CR6 inhibits the "Private-Line" tone oscillator. The diode CR1 serves to isolate the F1 Bistable Multivibrator output from triggering the Paging Bistable Multivibrator output when normal (non-paging) transmissions are commanded, and triggers F1 via the Paging Bistable Multivibrator during paging transmissions.

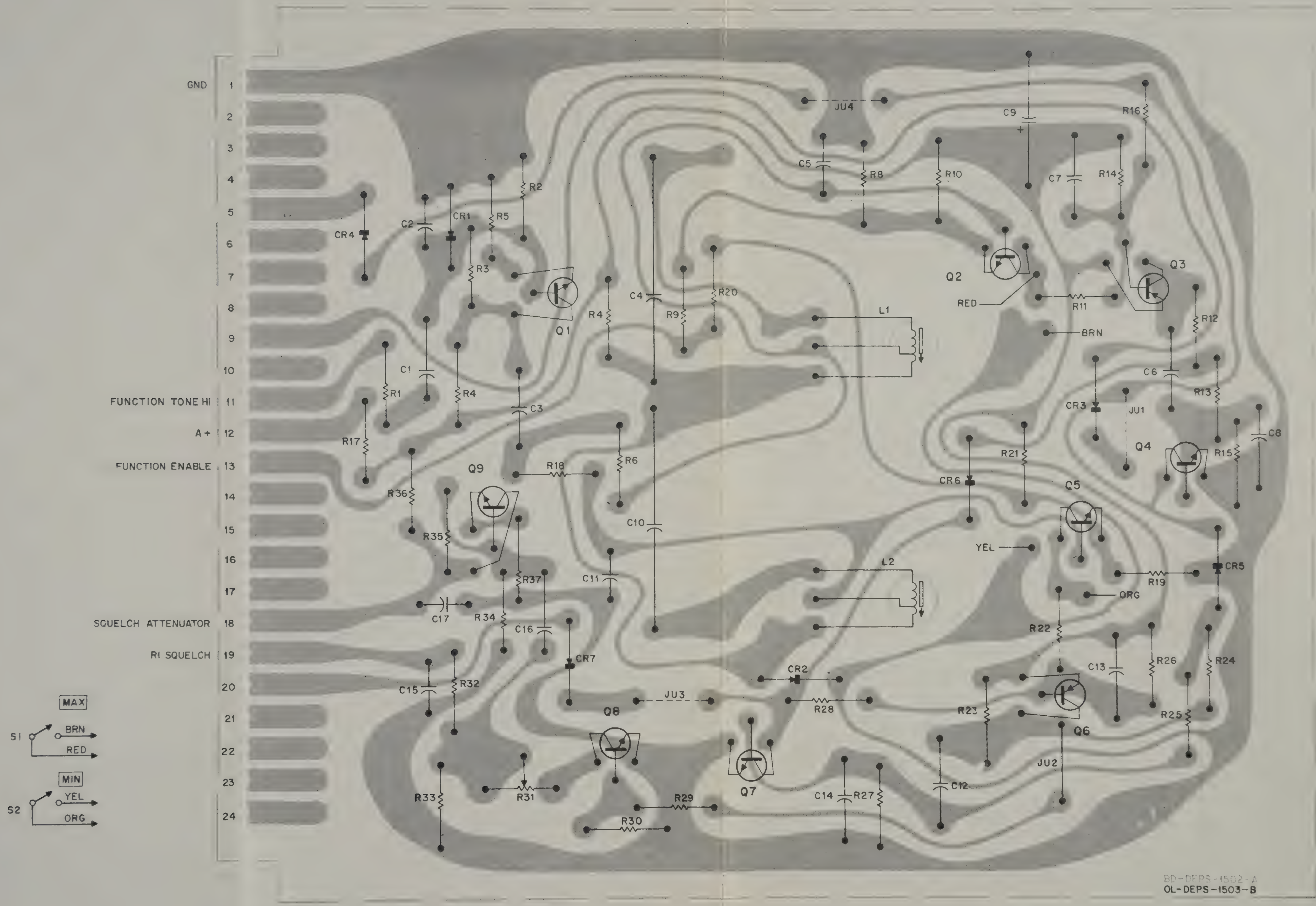
4. MAINTENANCE AND TROUBLESHOOTING

a. Techniques of Isolation

If a tone function cannot be performed from the remote control point, the malfunction may be

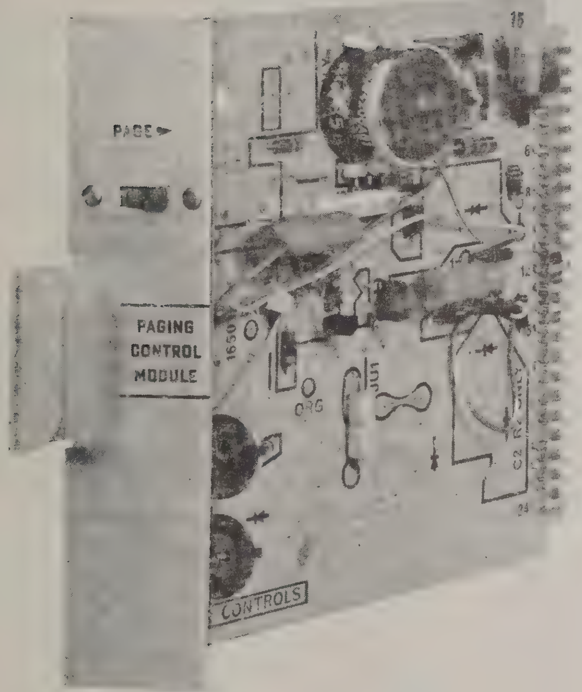
PAGING CONTROL MODULE

MOTOROLA INC. Communications Division
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172


GND
FUNCTION TONE HI
A+
FUNCTION ENABLE
SQUELCH ATTENUATOR
RI SQUELCH
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
MAX
S1
BRN
RED
MIN
S2
YEL
ORG
JU4
C9
R16
C5
R8
R10
C7
R14
R2
C2
CR1
R5
CR4
R3
Q1
Q2
Q3
RED
R11
BRN
R12
C4
R4
R9
R20
L1
C6
C1
R1
R4
C3
CR3
JU1
R13
R17
C8
Q4
R18
R6
R21
R15
Q9
R36
CR6
Q5
C10
R35
YEL
R37
C11
L2
R19
CR5
C17
R34
ORG
C16
R22
CR7
R26
R24
C13
C15
R32
CR2
JU3
R28
R23
Q8
R25
Q6
JU2
C12
R33
R31
R29
Q7
C14
R27
R30
BD-DEPS-1502-A
OL-DEPS-1503-B

PAGING CONTROL MODULE

MODEL TLN1253A



1. DESCRIPTION

The TLN1253A Paging Control Module is a fully transistorized, plug-in circuit module for the tone remote control chassis in Motorola base stations. All components and circuitry are mounted on a sturdy card with connecting terminals to mate with the interconnecting board of the chassis in which it is installed.

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Normal sub-audible "Private-Line" tone-coded transmission is permitted until the paging mode is selected. When the paging control module is selected, an 1850 Hz command tone is sent to the tone remote chassis, inhibiting the PL tone generator in the transmitter, and a non-PL carrier is transmitted. This carrier can be modulated by paging tones from a paging encoder located at the station. The page-tone-coded message would be heard only by non-PL receivers with the correct paging decoder. If the non-PL transmission is not modulated by paging tones, all non-PL receivers would hear the message.

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With a ground applied to the function enable line, pin 13, and switched 8.8 volts present at pin 8, the detector stage Q1 is operational. An 1850-Hz tone entering the module on pin 11 is amplified and clipped in the amplifier stage Q4. With the detector stage operational, the detected tone triggers the Paging Bistable Multivibrator Q2-Q3. When the bistable multivibrator turns on, a ground is applied to pins 1B and 2B.

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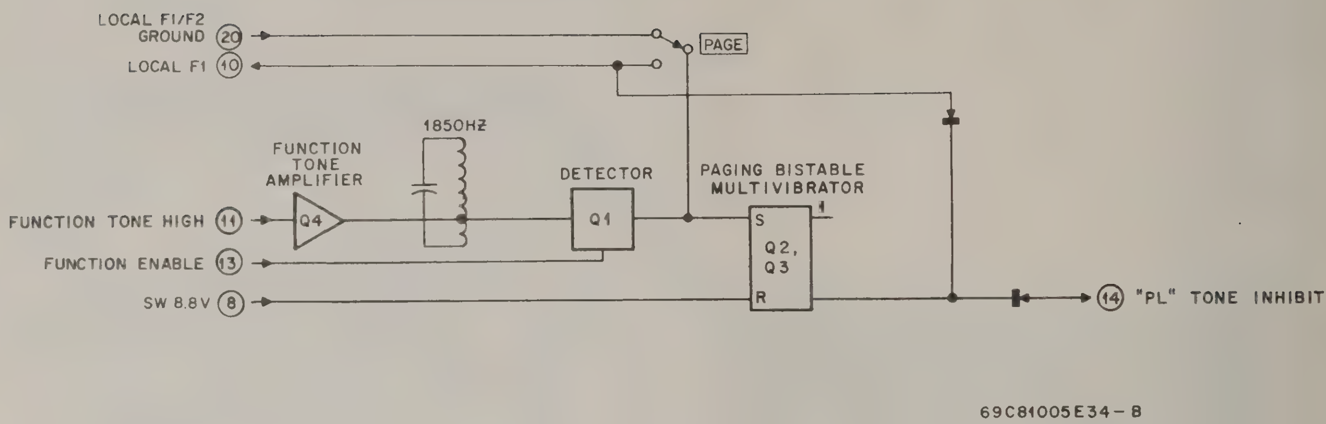
PAGING CONTROL MODULE

MOTOROLA INC. **Communications Division**
ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172



Functional Block Diagram

isolated to either the remote equipment or the remote control chassis. To determine the location of the fault, operate the station locally, and initiate the desired function tone from the module. If the desired function is performed, then the module is functioning properly. If the function does not perform, then the module is at fault.

b. Servicing the Module

(1) Servicing the Module in the Remote Control Chassis

The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module insert a Model TLN8799A Module Extension Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

(2) Servicing the Module Out of the Chassis

If the module is to be serviced without connection to its associated remote control chassis testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 2, 13	Ground
4	10-kilohms to pin 8
8	1000-ohms to ground; 200-ohms to pin 12
11	Oscillator input
12	A+; 13.6 volts dc

d. Module Malfunction Location Techniques

(1) Paging Bistable Multivibrator

(a) Connect a dc voltmeter between pin 4 and pin 2.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q1. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1850 Hz. The voltmeter reading should fall to zero volts, indicating that the bistable multivibrator has changed state. If the change of state does not occur, check the detector stage Q1, then the bistable multivibrator Q2-Q3. If the change of state occurs, look to the function tone amplifier for a malfunction.

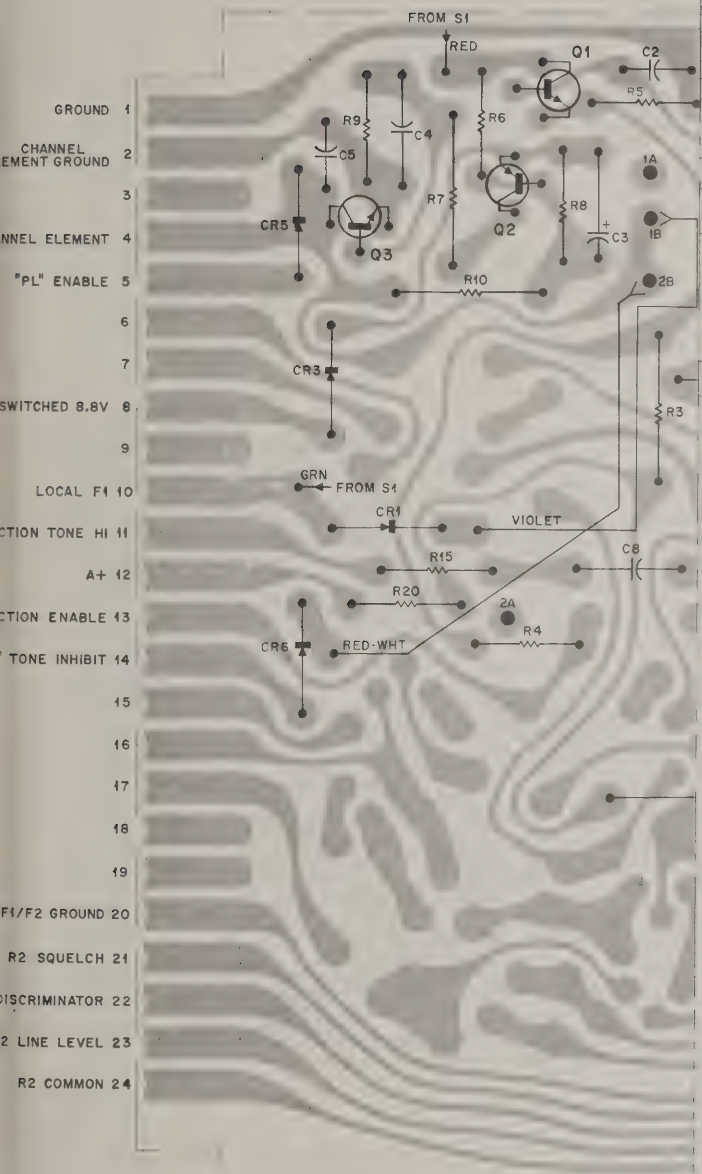
(2) Function Tone Amplifier Stage

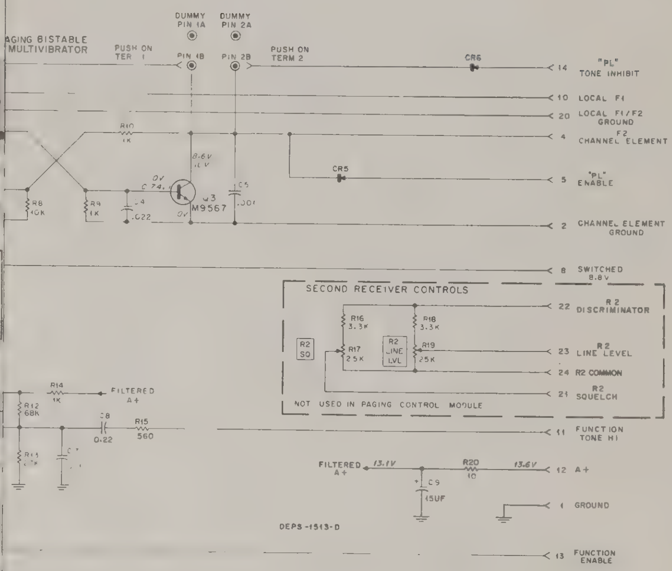
(a) Connect an ac voltmeter from the capacitor connected to the collector of Q4 to ground.

(b) Connect an audio oscillator from pin 11 to ground. Adjust the oscillator output to -10 dBm at 1800 Hz.

(c) The measured output should be at least +10 dBm. When viewed with an oscilloscope, the waveform should be well into a clipped condition.

(d) If the aforementioned conditions are not attained, measure the voltages on the function tone detector stage.

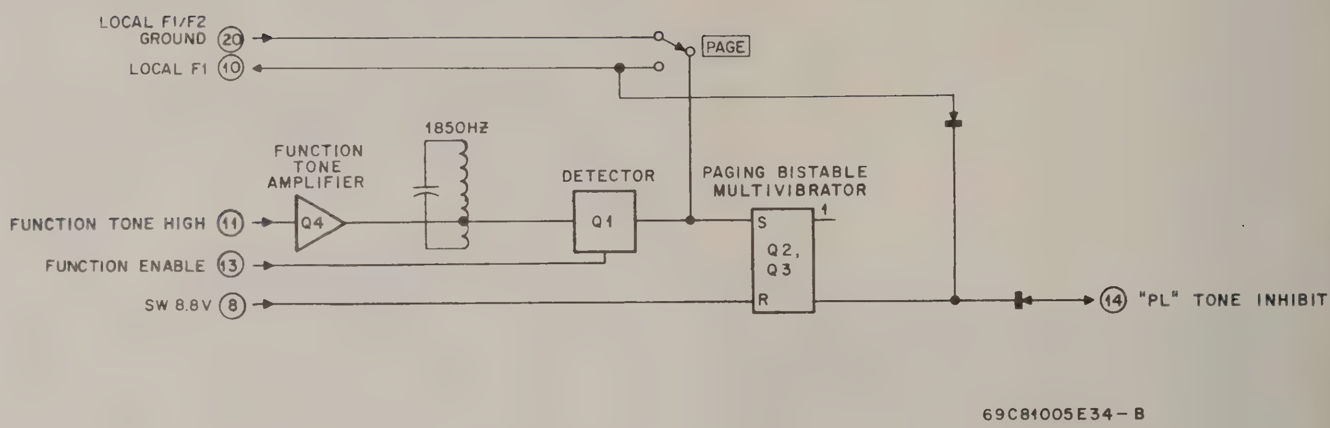




PAGING CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Paging Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81005E17-D
3/1/72-UP



Functional Block Diagram

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The module may be serviced while connected to the remote control chassis in the station. To gain access to the module, remove the module insert a Model TLN8799A Module Extension Board, and insert the module into this service extension. All points on the module are now accessible for voltage measurements, waveform observations, or other test functions.

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If the module is to be serviced without connection to its associated remote control chassis testing may be done if the proper power and terminations are connected to the module.

Make the following connections to the module:

PIN NUMBER	CONNECTION
1, 2, 13	Ground
4	10-kilohms to pin 8
8	1000-ohms to ground; 200-ohms to pin 12
11	Oscillator input
12	A+; 13.6 volts dc

d. Module Malfunction Location Techniques

(1) Paging Bistable Multivibrator

(a) Connect a dc voltmeter between pin 4 and pin 2.

(b) Connect an audio oscillator (high side) through a coupling capacitor to the base of Q1. The output level must not exceed 1 volt.

(c) Adjust the audio oscillator frequency to 1850 Hz. The voltmeter reading should fall to zero volts, indicating that the bistable multivibrator has changed state. If the change of state does not occur, check the detector stage Q1, then the bistable multivibrator Q2-Q3. If the change of state occurs, look to the function tone amplifier for a malfunction.

(2) Function Tone Amplifier Stage

(a) Connect an ac voltmeter from the capacitor connected to the collector of Q4 to ground.

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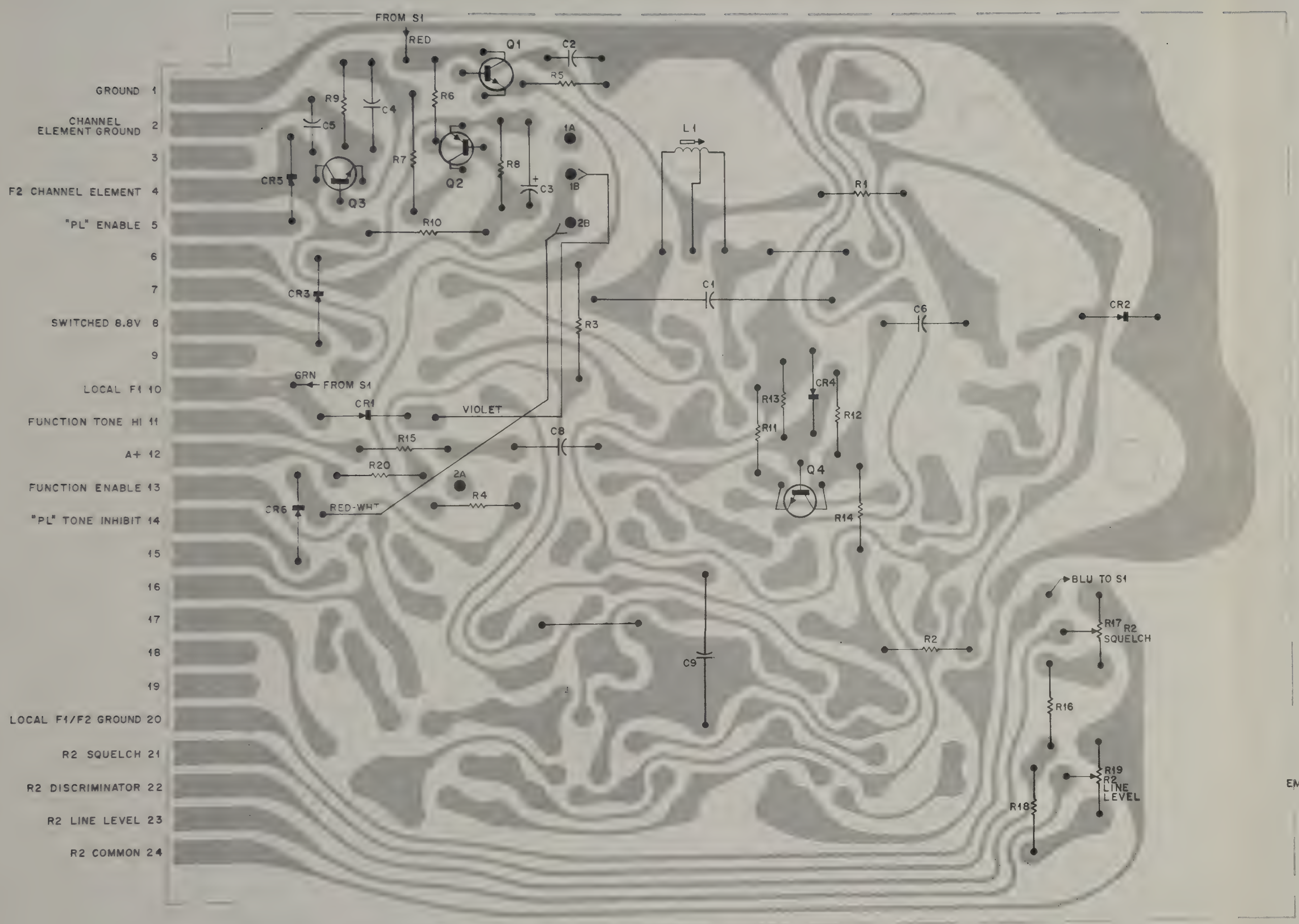
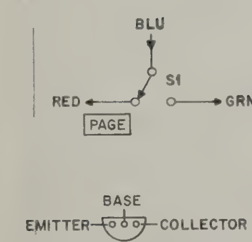
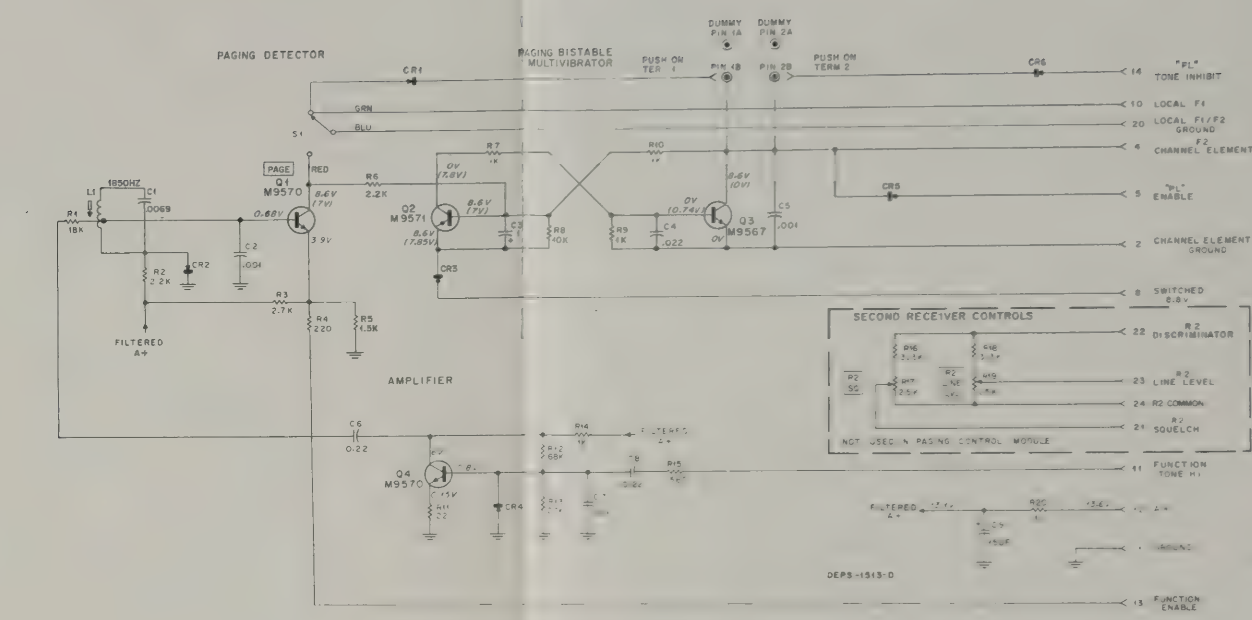


OL-DEPS-1512-D
BD-DEPS-1495-A



TRANSISTOR DETAIL
(ALL)



DEPS-1513-D

PAGING CONTROL MODULE

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Paging Control Module
Schematic Diagram and Circuit Board Detail
Motorola No. 63P81005E17-D
3/1/72-UP

STATION STATUS

NOTE

ıded for a record of jumper connections.
ormation at the time of installation and
in servicing, modification or module

MODEL	NOTES
LII DRIVER MODULE	
STATION LOGIC MODULE	
SINGLE-TONE DECODER MODULE	
GUARD TONE DECODER MODULE	
SQUELCH GATE MODULE (RPTR STATIONS)	
TIME-OUT TIMER	
"WILD CARD" CONTROL MODULE	
F1 CONTROL MODULE	
F1-"PRIVATE-LINE" DISABLE CONTROL MC	
CONTROL CHASSIS INTERCONNECT BOARD	
SQUELCH CONTROL MODULE	
"PRIVATE-LINE" CONTROL MODULE	
PAGING CONTROL MODULE (BASE STATIONS	
REPEATER CONTROL MODULE (RPTR STATI	

Communications Division

)1 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

REVISIONS

63P81005E17-D

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN4044A	C3	WAS 8D82905G02, .022 uF	Q2 BASE
	R1	WAS 6S129667, 22K	L1 TAP
	R3	WAS 6S2028, 2.2K	Q1 EMITTER
	R5	WAS 6S129805, 1K	
TLN4044A-1			

PARTS LIST

TLN4044A Decoder Board PL-483-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 50 v; unl. stated
C1	8D84326A15	.0069 ±2%
C2	21D82187B29	.001; 100 v
C3	23D82783B08	1 ±20%; 35 v
C4	8D82905G02	.022
C5	21D82187B29	.001; 100 v
C6	8D82905G11	0.22
C7	21D82187B29	.001; 100 v
C8	8D82095G11	0.22
C9	23K865136	15 ±20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 6	48C82392B03	silicon
		COIL ASSEMBLY, inductor:
L1	1V80702B11	1H; incl. ground clip
		TRANSISTOR: (SEE NOTE)
Q1	48R869570	N-P-N; M9570
Q2	48R869571	P-N-P; M9571
Q3	48R869567	N-P-N; M9567
Q4	48R869570	N-P-N; M9570
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R1	6S131526	18K ±5%
R2	6S128689	2.2K
R3	6S5652	2.7K ±5%; 1/2 w
R4	6S131275	220 ±5%
R5	6S129681	1.5K ±5%
R6	6S128689	2.2K
R7	6S6229	1K; 1/2 w
R8	6S129225	10K
R9	6S127802	1K
R10	6S6229	1K; 1/2 w
R11	6S124A08	22 ±5%
R12	6S129299	68K ±5%
R13	6S129886	27K ±5%
R14	6S129805	1K ±5%
R15	6S129620	560
R16	6S129231	3.3K
R17	18C83083G03	variable; 25K
R18	6S129231	3.3K
R19	18C83083G03	variable; 25K
R20	6S129755	10
	NON-REFERENCED ITEM	
	42S10217A01	STRAP, cable harness

TLN4056A Paging Decoder Panel Kit PL-484-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH, slide:
S1	40B83204B01	dpdt
	NON-REFERENCED ITEMS	
	1V80702B25	PANEL ASSY. (riveted): incl. ref. part S1
	45B83914G01	GUIDE, card: 2 used

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

STATION STATUS

NOTE

The following chart is included for a record of jumper connections. Fill in the applicable information at the time of installation and keep it up-to-date to aid in servicing, modification or module replacement.

MODEL	MOD. USED (X)	JUMPER INSTALLED (X)											NOTES
		JU1	JU2	JU3	JU4	JU5	JU6	JU7	JU8	JU9	JU10	JU11	
LI[illegible] DRIVER MODULE													
STATION LOGIC MODULE													
SINGLE-TONE DECODER MODULE													
GUARD TONE DECODER MODULE													
SQUELCH GATE MODULE (RPTR STATIONS)													
TIME-OUT TIMER													
"WILD CARD" CONTROL MODULE													
F1 CONTROL MODULE													
F1-"PRIVATE-LINE" DISABLE CONTROL MODULE													
CONTROL CHASSIS INTERCONNECT BOARD													
SQUELCH CONTROL MODULE													
"PRIVATE-LINE" CONTROL MODULE													
PAGING CONTROL MODULE (BASE STATIONS)													
REPEATER CONTROL MODULE (RPTR STATIONS)													

MOTOROLA INC.
ENGINEERING PUBLICATIONS
Communications Division
1301 E. ALGONQUIN ROAD
SCHAUMBURG, ILLINOIS 60172

7/31/70-UP

68P81010E32-O

INSTRUCTION MANUAL REVISION SMR-1302R

Replaces SMR-1223B

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL (S) AFFECTED:

68P81011E75-A 450-470 MHz Base Station, Tone Remote Control

REVISION DETAILS

POWER AMPLIFIER

Schem. Diag. No.	Model and New Suffix	Circuit Bd. Detail	Circuitry Change
63E81010E08	TLE1362A-1	None	None

Ref. Sym.	Action	Part No.	Description
R1	Change to	17C82291B09	RESISTOR, fixed: 2.2k ±5%; 5 W
Non-Ref.	Add	31R131744	TERMINAL STRIP: No 1 & 3 insulated; No. 2 mtg. (used with R1)

TIME-OUT TIMER

Schem. Diag. No.	Model and New Suffix	Circuit Bd. Detail	Circuitry Change
63P81001E13	TLN1179A (TLN8769A)	Same	None

Ref. Sym.	Action	Part No.	Description
CR1 thru 8, CR10 thru 14	Change to	48C83654H01	SEMICONDUCTOR DEVICE, diode: silicon

instruction manual revision SMR-1492A

For Instruction Manuals:

450-470 MHz "Compa-Station" Base Radio

68P81056A30-A 68P81002E35-A
68P81002E40-A 68P81006E60-O
68P81006E65-O 68P81006E70-A

450-470 MHz "Compa-Station" Repeater (RT)

68P81002E45-C 68P81002E30-A

450-470 MHz "Compa-Station" Community Repeater (RT)

68P81056A35-A

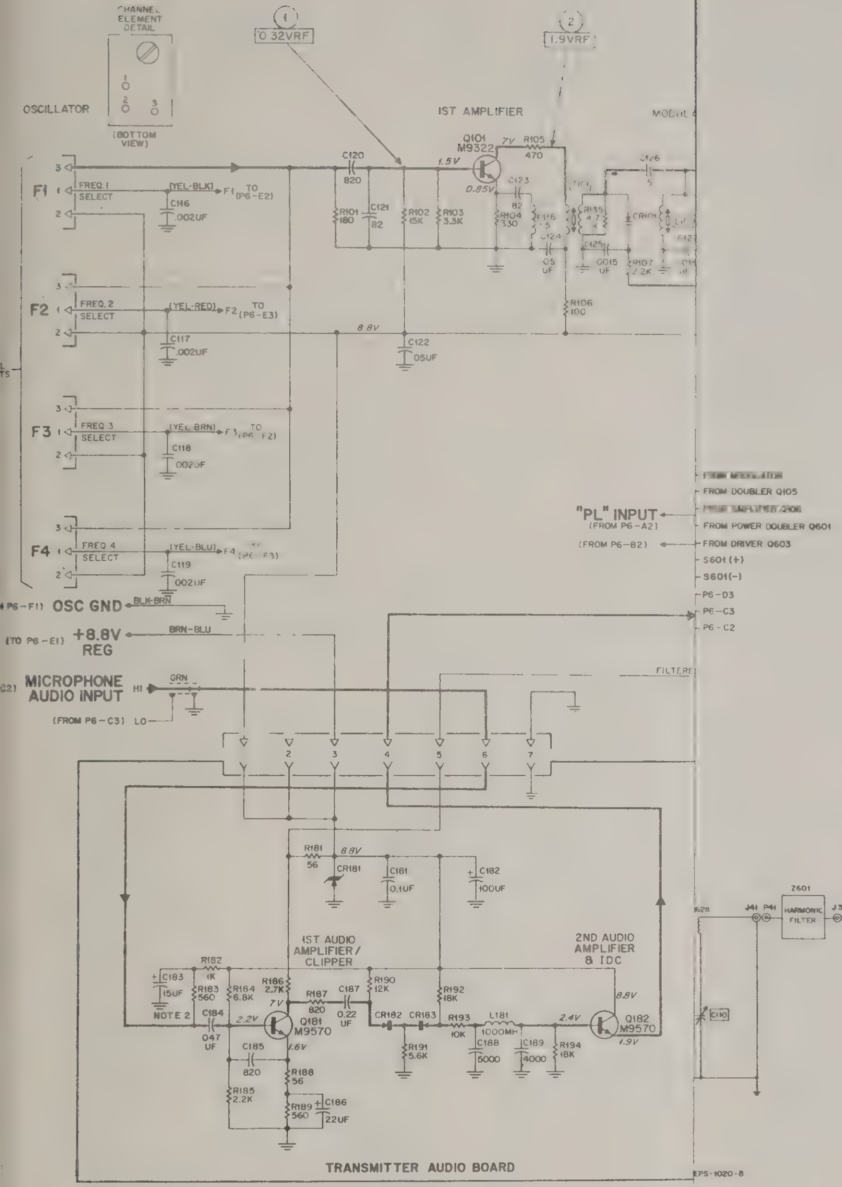
450-470 MHz Base Station

68P81011E70-O 68P81011E75-A

450-470 MHz Repeater (RT) Station

68P81011E80-O 68P81011E85-O

In the transmitter section, replace schematic diagram 63P81057A02, circuit board details PEPS-714 and PEPS-3621 with the attached 63P81057A02-J, PEPS-714-F and PEPS-3621-F.



NOTES:

1. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS (K = 1000). CAPACITOR VALUES ARE IN PICOFARADS. INDUCTOR VALUES ARE IN MICROHENRIES.
2. R183 USED ONLY IN LOCAL CONTROL MODELS WITHOUT MONITOR INTERCOM OPTION.
3. COMPONENT REFERENCES WITHIN RECTANGLES ARE MARKED ON THE EQUIPMENT.
4. ALL DC VOLTAGES ARE MEASURED WITH A MOTOROLA TRANSISTORIZED DC MULTIMETER OR EQUIVALENT WITH 11 MEGOHMS INPUT RESISTANCE. VOLTAGES SHOWN ARE WITH TRANSMITTER IN KEYED POSITION.

EPD-21324-B

EXCITER-TRANSMITTER

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Exciter-Transmitter
Schematic Diagram
Motorola No. 63P81057A02-J
2/7/73-UP

instruction manual revision SMR-1492A

For Instruction Manuals:

450-470 MHz "Compa-Station" Base Radio

68P81056A30-A 68P81002E35-A
68P81002E40-A 68P81006E60-O
68P81006E65-O 68P81006E70-A

450-470 MHz "Compa-Station" Repeater (RT)

68P81002E45-C 68P81002E30-A

450-470 MHz "Compa-Station" Community Repeater (RT)

68P81056A35-A

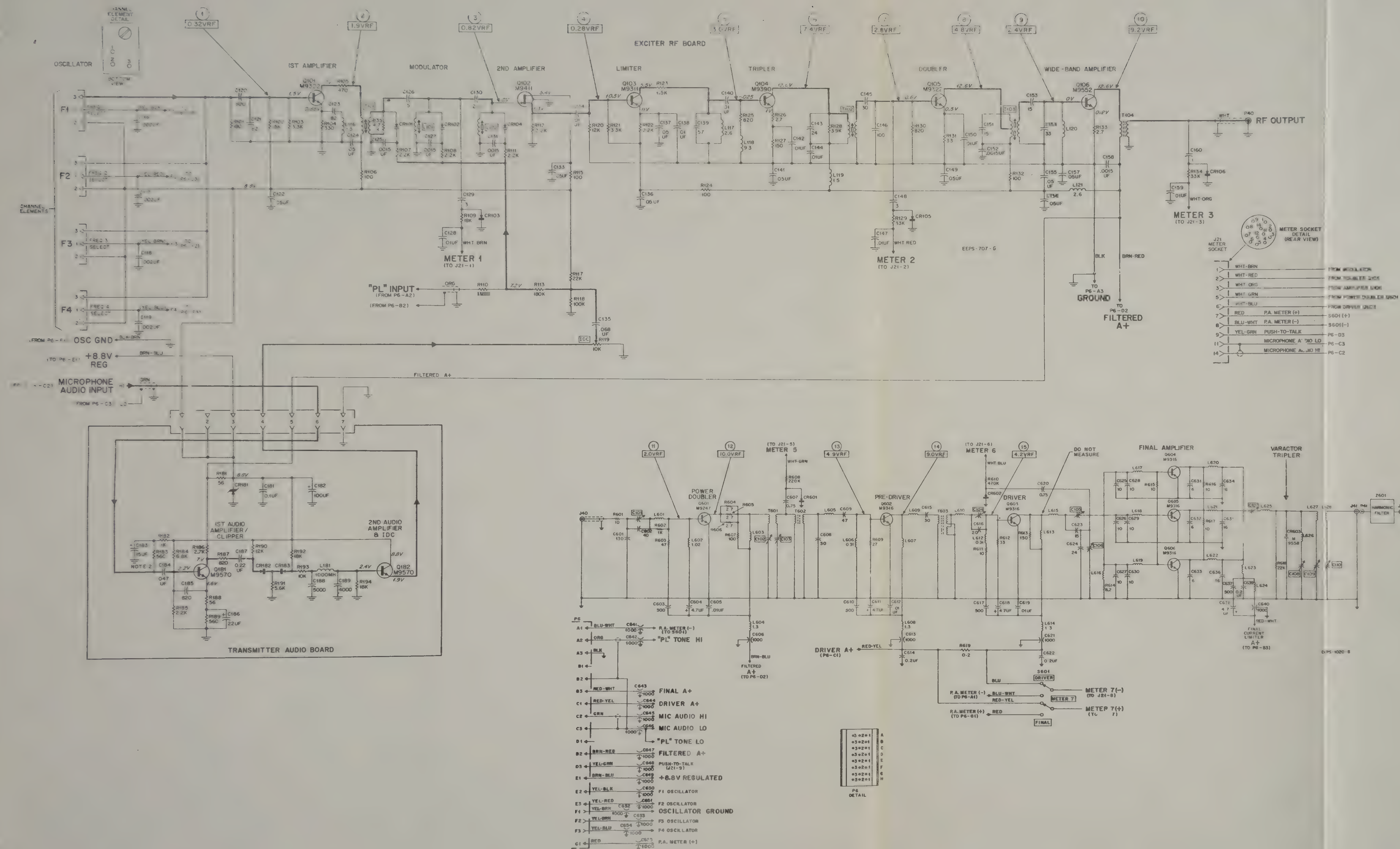
450-470 MHz Base Station

68P81011E70-O 68P81011E75-A

450-470 MHz Repeater (RT) Station

68P81011E80-O 68P81011E85-O

In the transmitter section, replace schematic diagram 63P81057A02, circuit board details PEPS-714 and PEPS-3621 with the attached 63P81057A02-J, PEPS-714-F and PEPS-3621-F.



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EPD-21324-B

EXCITER-TRANSMITTER

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Exciter-Transmitter
Schematic Diagram
Motorola No. 63P81057A02-J
2/7/73-UP

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

TLE6512A Transmitter Chassis Kit PL-660-B

		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C107	19C83221D01	var: 2.93-13.5; 850 V peak
C108, 109	19C83444C04	var: 1.3-5.2; 1100 V peak
C110	19C83444C02	var: 1.74-6.57; 750 V peak
C606, 613 621, 640 thru 655	21K861219	feed-thru type; 1000 +100-0%; coded RED
C614, 622	21C82372C05	0.2 uF +80-20%; 25 V
C638	23K865137	4.7 uF ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR601, 602	48C82139G01	germanium
CR603	48R869558	silicon; varactor; type M9558
		CONNECTOR, receptacle:
J21	9C83478E01	female; 12-contact
J40	9B82323G01	female; min; coaxial
J41	9C83663C01	female; min; coaxial
		COIL, RF:
L625	24C84095A01	2 turns
L626	24A83450C01	2 turns
L627	24A83002H01	1/2 turn
L628	24A83003H01	1/2 turn
		CONNECTOR, plug:
P6		includes: 14C82337A09 BODY: 24-contact type; 29C82335A01 TERMINAL, contact male; 29C82336A01 TERMINAL, contact female; 29C82335A02 TERMINAL, contact: male (specify quantity); 29C82336A02 TERMINAL, contact: female (specify); 15D83934A01 SHELL
		RESISTOR, fixed: 1/4 W unl. stated
R608	6S124B06	220K ±5%
R610	6S129149	470K ±5%
R618	6S128685	22K ±10%
R619	17C82586H01	0.2; ±5%; 5 W
		SWITCH, slide:
S601	40B83204B01	dpdt
	NON-REFERENCED ITEMS	
	64B83007H01	COVER
	15B84006A03	COVER, exciter: includes legend

Harmonic Filter PL-371-O

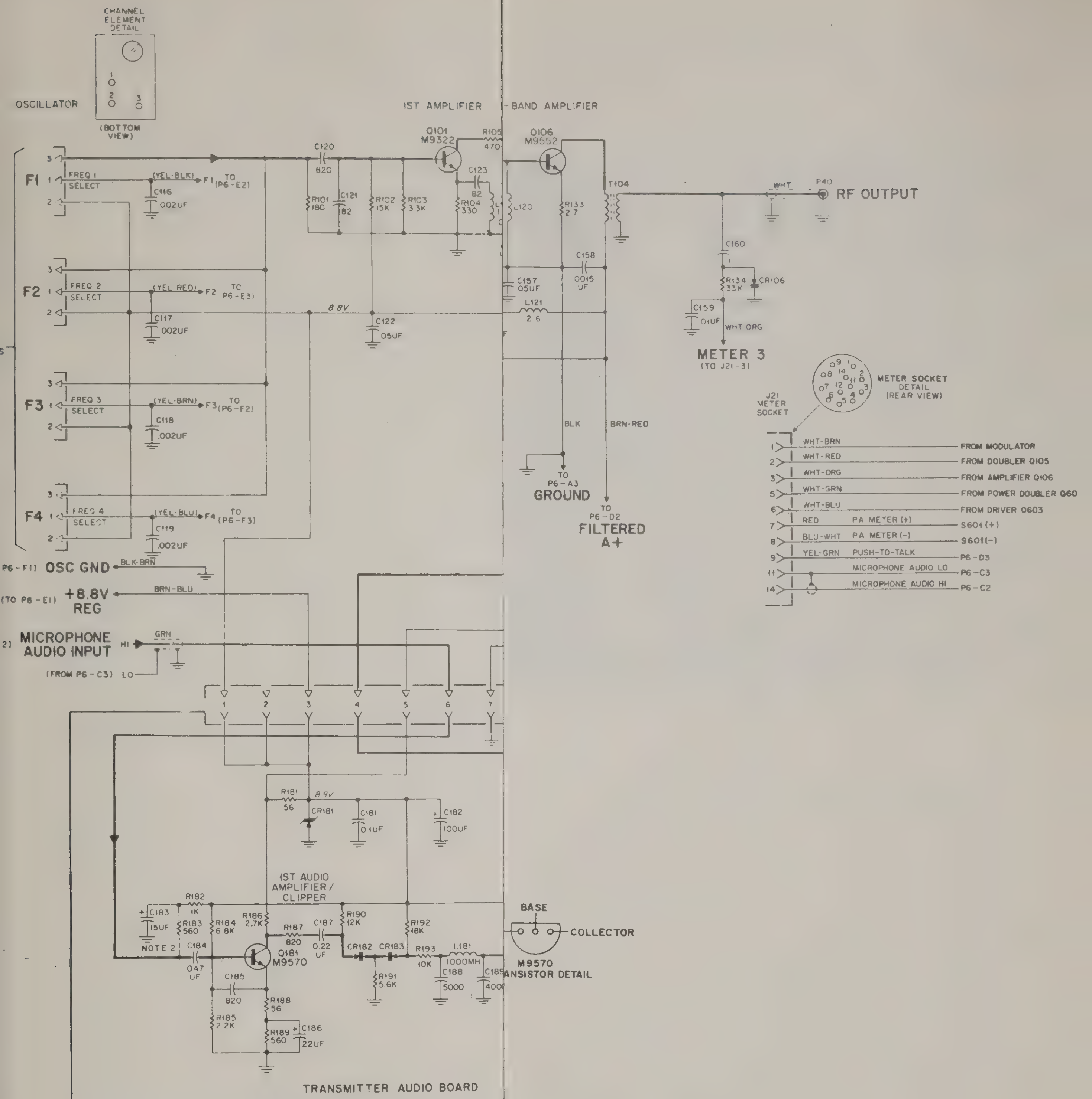
	TFE6003A or TFE6004A	FILTER, RF: 450-460 MHz FILTER, RF 460-470 MHz

Channel Element PL-658-O

	TLN1190A	Transmitter control

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

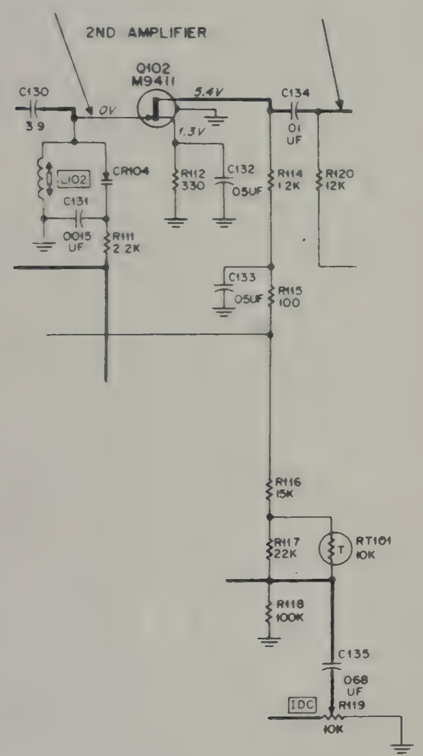


CHANNEL ELEMENT DETAIL
(BOTTOM VIEW)
OSCILLATOR
1ST AMPLIFIER
-BAND AMPLIFIER
Q101 M9322
Q106 M9552
RF OUTPUT
F1 FREQ 1 SELECT
F2 FREQ 2 SELECT
F3 FREQ 3 SELECT
F4 FREQ 4 SELECT
METER 3 (TO J21-3)
METER SOCKET DETAIL (REAR VIEW)
J21 METER SOCKET
TO P6-A3 GROUND
TO P6-D2 FILTERED A+
WHT-BRN FROM MODULATOR
WHT-RED FROM DOUBLER Q105
WHT-ORG FROM AMPLIFIER Q106
WHT-GRN FROM POWER DOUBLER Q60
WHT-BLU FROM DRIVER Q603
RED PA METER (+) S601 (+)
BLU-WHT PA METER (-) S601(-)
YEL-GRN PUSH-TO-TALK P6-D3
MICROPHONE AUDIO LO P6-C3
MICROPHONE AUDIO HI P6-C2
P6-F1) OSC GND
(TO P6-E1) +8.8V REG
MICROPHONE AUDIO INPUT
(FROM P6-C3)
1ST AUDIO AMPLIFIER / CLIPPER
Q181 M9570
BASE
COLLECTOR
M9570 ANSISTOR DETAIL
NOTE 2
TRANSMITTER AUDIO BOARD

REVISIONS

63P81057A02-J

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
TLE6392A	Q104	WAS TYPE M9322	EXCITER RF BOARD	EXCITER BD. PEPS-714
	R123	WAS 1.2K; ±5%; 1/4 W		
	R125	WAS 330; ±5%, 1/4 W		
	R126	WAS 3.3; ±5%; 1/4 W		
TLE6392A-1 TTE1170AA TTE1133AA TTE1134AA		CONTAINED TLE6412A TRANSMITTER CHASSIS KIT WHICH INCLUDED 1V80701B33 DOUBLER-DRIVER CIRCUIT BD.	Q602 AND METER 7 CIRCUITS	EXCITER BD. PEPS-1319
[illegible]AA-1 TTE1133AA-1 TTE1134AA-1		CHANGED TO TLE6512A TRANSMITTER CHASSIS KIT AND TLN4220A DOUBLER-DRIVER CIRCUIT BOARD		PEPS-2593
[illegible]E6392A-2	R135	ADDED	T101 SECONDARY	EXCITER BD. PEPS-714
[illegible]E6392A-3 TLN8956A-1		REVISED PRINTED CIRCUIT BOARD PLATING		EXCITER BD. PEPS-3621-C
TLE6392A-4		CIRCUIT WAS AS SHOWN BELOW:	2ND AMPL.	EXCITER BD. PEPS-3621-D



PARTS LIST

TLE6412A Transmitter Chassis Kit — PL-370-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C107	19C83221D01	var: 2.93-13.5; 850 V peak
C108, 109	19C83444C04	var: 1.3-5.2; 1100 V peak
C110	19C83444C02	var: 1.74-6.57; 750 V peak
C606, 613 621, 640 thru 655	21K861219	feed-thru type; 1000 +100-0%; coded RED
C614, 622	21C82372C05	0.2 uF +80-20%; 25 V
C638	23K865137	4.7 uF ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR601, 602	48C82139G01	germanium
CR603	48R869558	silicon; varactor; type M9558
		CONNECTOR, receptacle:
J21	9C857358	female; 12-contact
J40	9B82323G01	female; min; coaxial
J41	9C83663C01	female; min; coaxial
		COIL, RF:
L611	24K832590	choke; 1.3 uH
L625	24C84095A01	2 turns
L626	24A83450C01	2 turns
L627	24A83002H01	1/2 turn
L628	24A83003H01	1/2 turn
		CONNECTOR, plug:
P6		c/o: 14C82337A09 BODY: 24-contact type 29C82335A02 TERMINAL, contact: male (specify quantity) 29C82336A02 TERMINAL, contact: female (specify) 15D83934A01 SHELL
		RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R608	6S124B06	220K ±5%
R610	6S129149	470K ±5%
R618	6S128685	22K

EPD-12967-O

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

TLE6512A Transmitter Chassis Kit — PL-660-B

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unl. stated
C107	19C83221D01	var: 2.93-13.5; 850 V peak
C108, 109	19C83444C04	var: 1.3-5.2; 1100 V peak
C110	19C83444C02	var: 1.74-6.57; 750 V peak
C606, 613 621, 640 thru 655	21K861219	feed-thru type; 1000 +100-0%; coded RED
C614, 622	21C82372C05	0.2 uF +80-20%; 25 V
C638	23K865137	4.7 uF ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR601, 602	48C82139G01	germanium
CR603	48R869558	silicon; varactor; type M9558
		CONNECTOR, receptacle:
J21	9C83478E01	female; 12-contact
J40	9B82323G01	female; min; coaxial
J41	9C83663C01	female; min; coaxial
		COIL, RF:
L625	24C84095A01	2 turns
L626	24A83450C01	2 turns
L627	24A83002H01	1/2 turn
L628	24A83003H01	1/2 turn
		CONNECTOR, plug:
P6		includes: 14C82337A09 BODY: 24-contact type; 29C82335A01 TERMINAL, contact male; 29C82336A01 TERMINAL, contact female; 29C82335A02 TERMINAL, contact: male (specify quantity); 29C82336A02 TERMINAL, contact: female (specify); 15D83934A01 SHELL
		RESISTOR, fixed: 1/4 W unl. stated
R608	6S124B06	220K ±5%
R610	6S129149	470K ±5%
R618	6S128685	22K ±10%
R619	17C82586H01	0.2; ±5%; 5 W
		SWITCH, slide:
S601	40B83204B01	dpdt
	NON-REFERENCED ITEMS	
	64B83007H01	COVER
	15B84006A03	COVER, exciter; includes legend

Harmonic Filter — PL-371-O

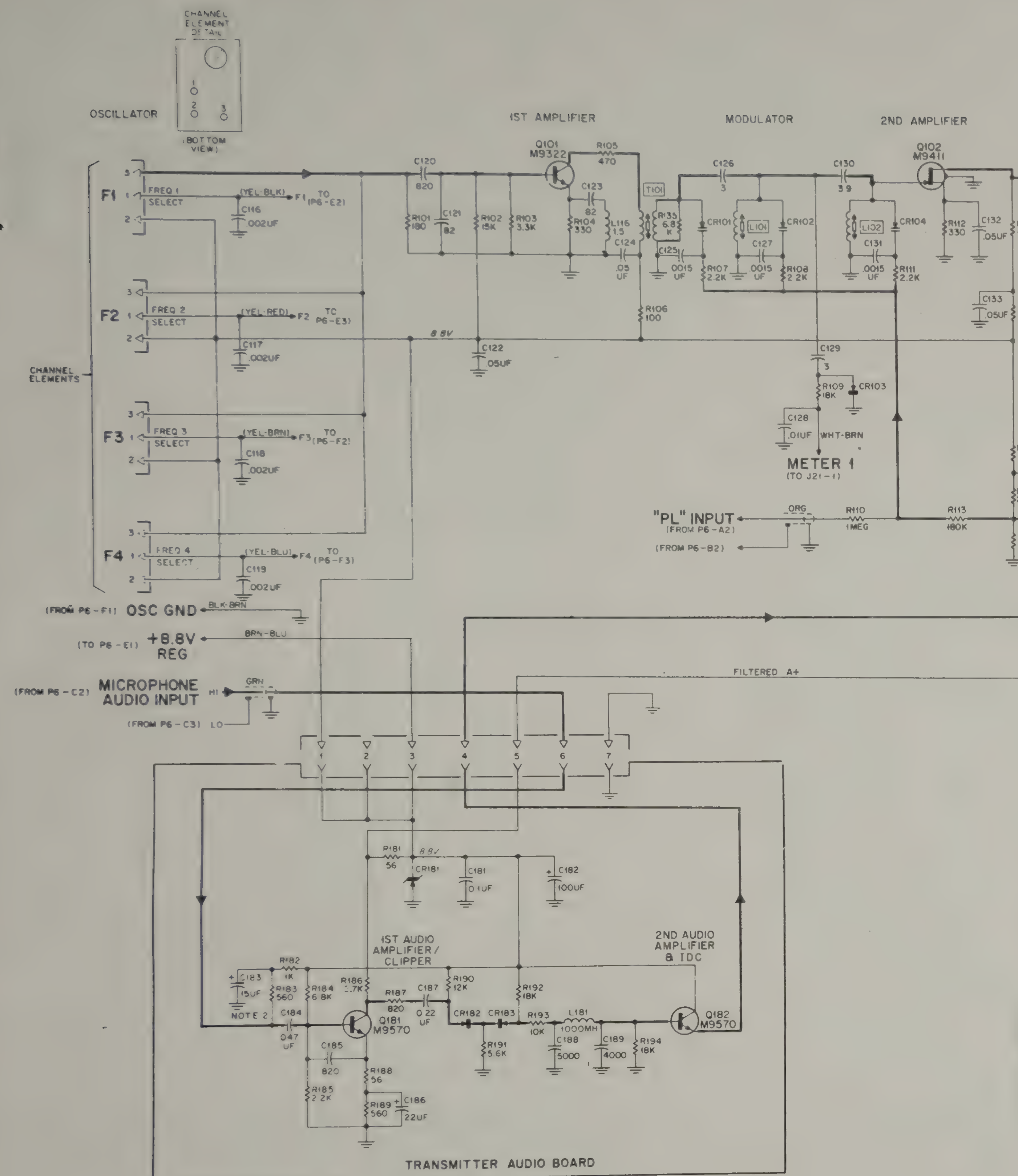
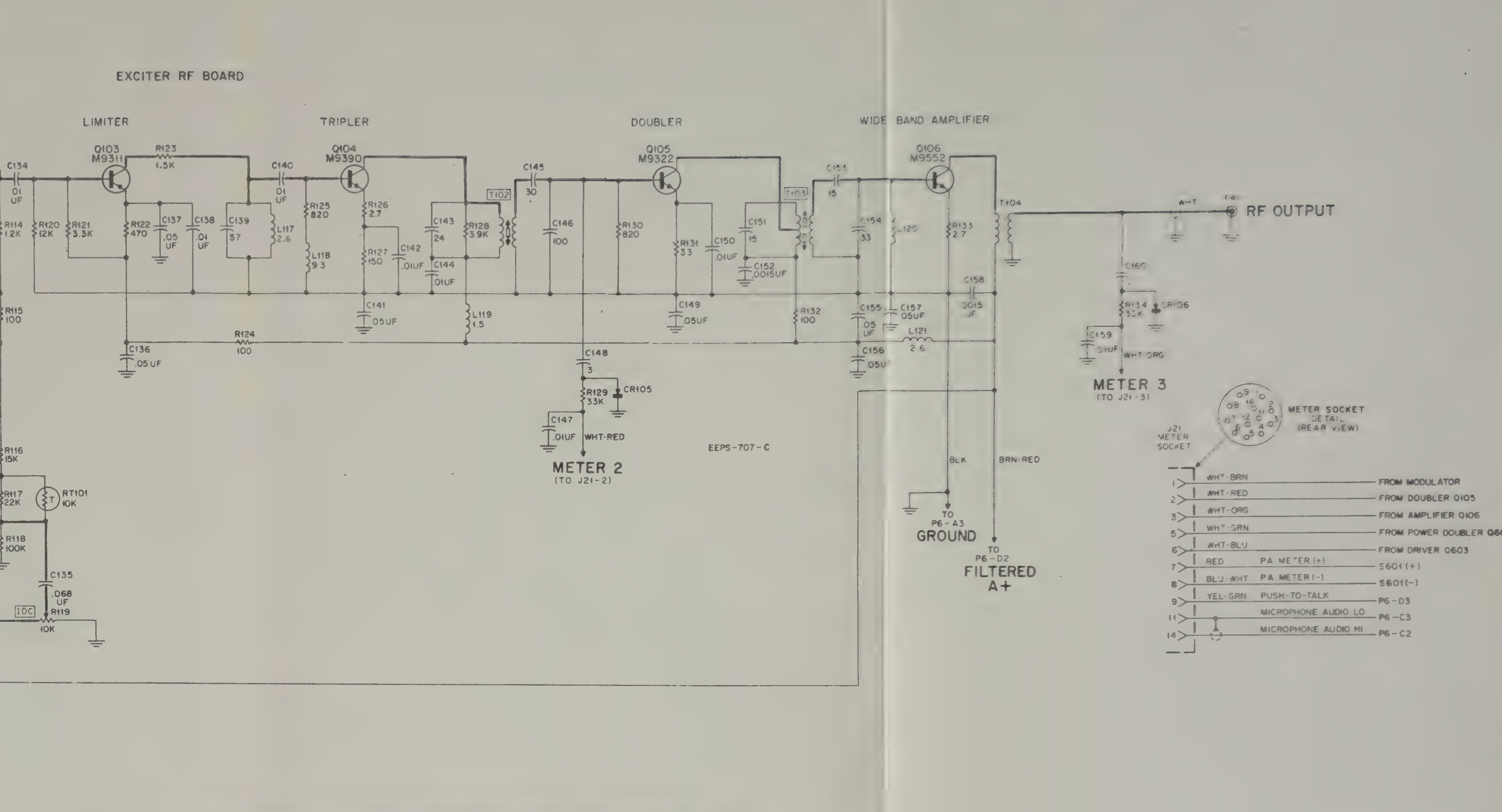
	TFE6003A or TFE6004A	FILTER, RF: 450-460 MHz FILTER, RF 460-470 MHz

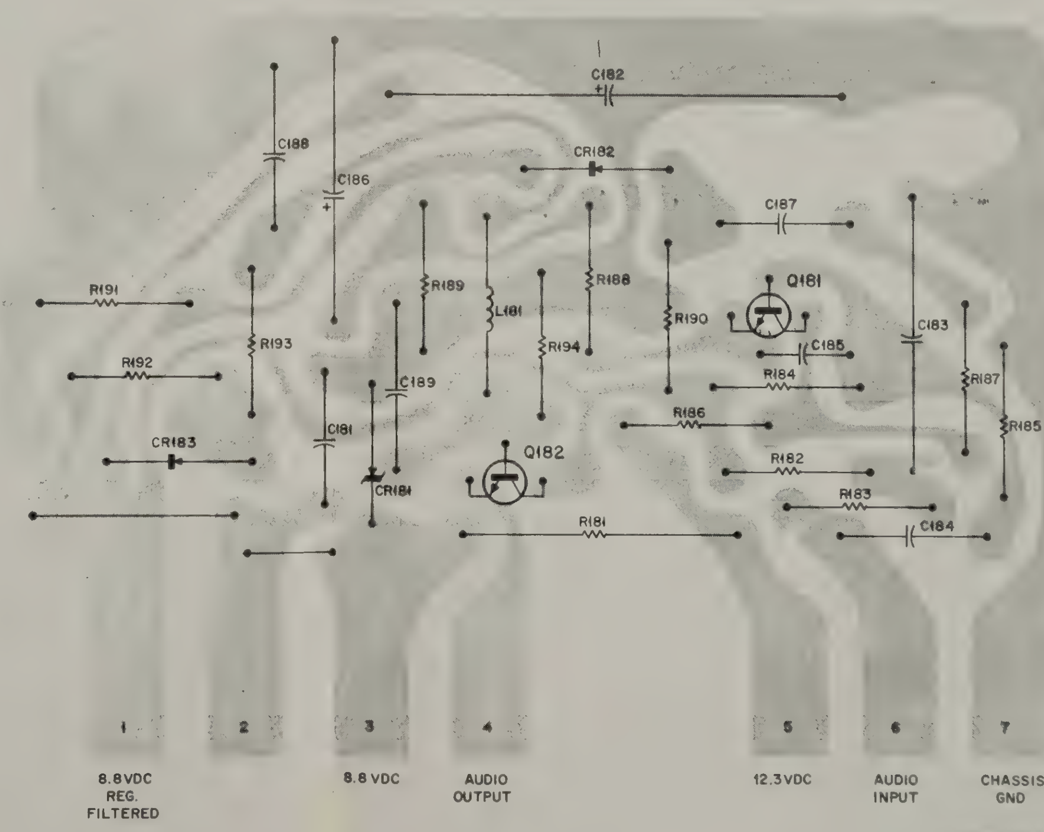
Channel Element — PL-658-O

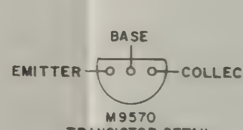
	TLN1190A	Transmitter control

NOTE:

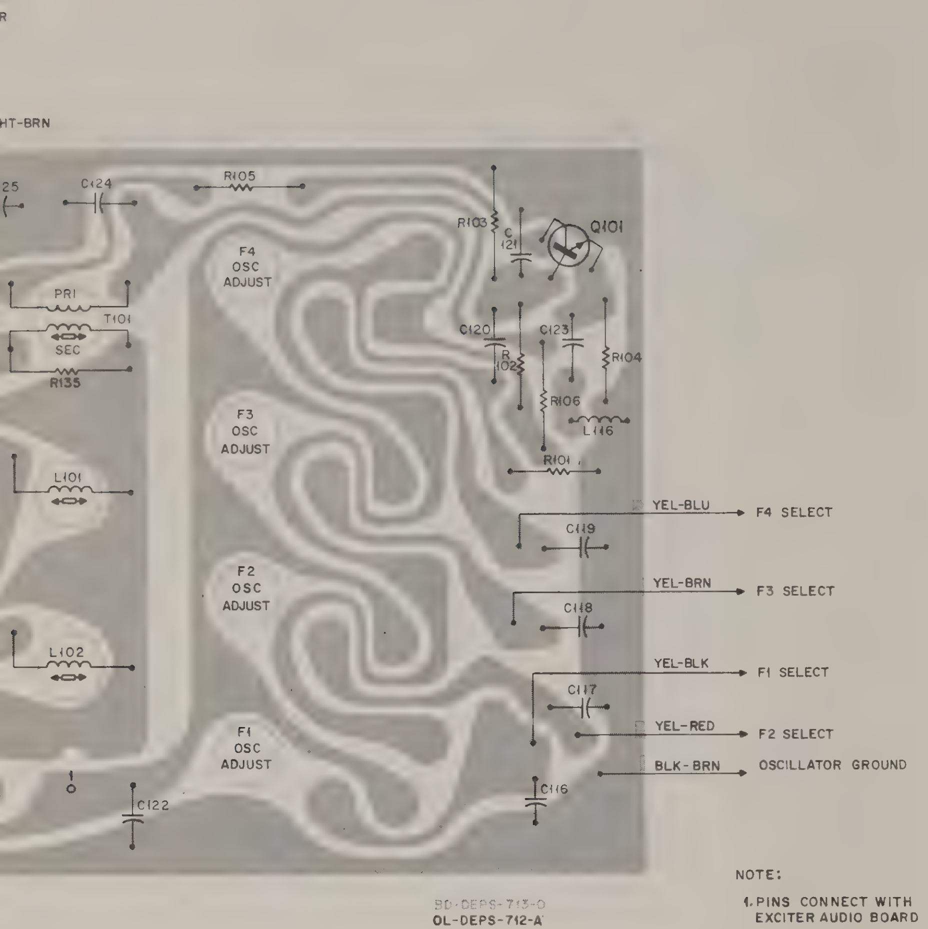
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





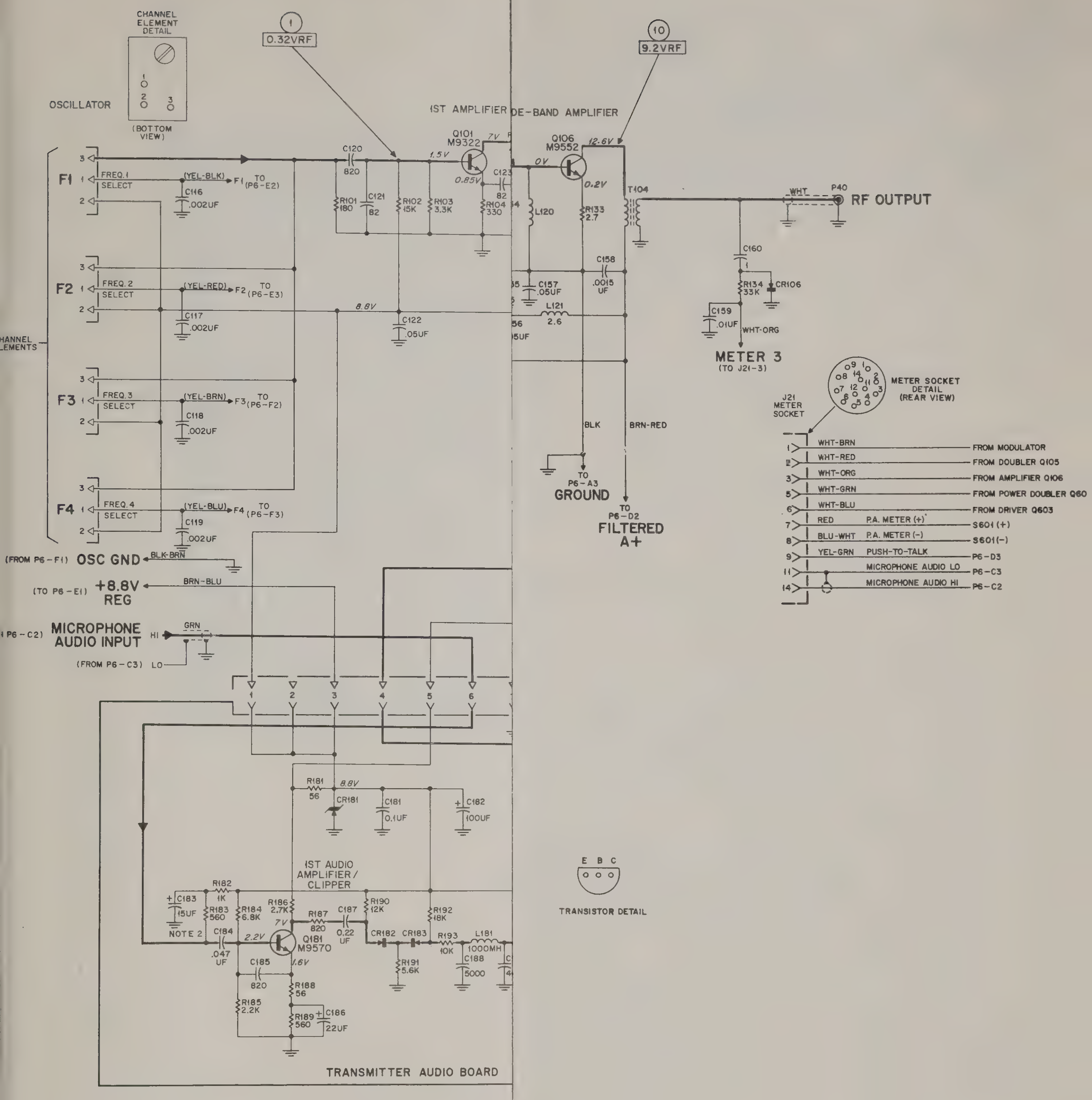
Transmitter Audio Board TLN8956A



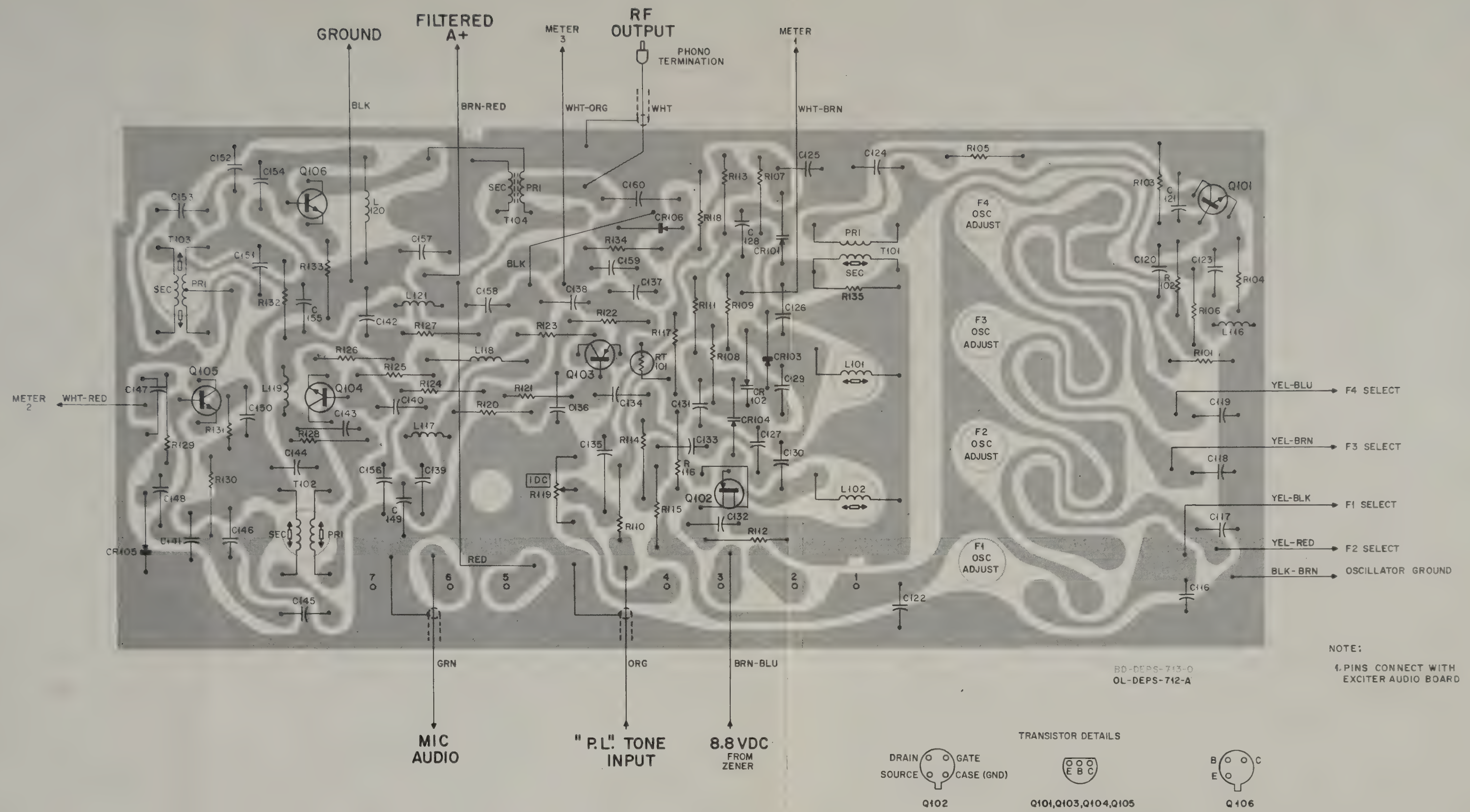
EXCITER-TRANSMITTER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Exciter RF Board TLE6392A &
Transmitter Audio Board TLN8956A
Circuit Board Details
Motorola No. PEPS-714-F
2/7/73-UP



CHANNEL ELEMENT DETAIL
(BOTTOM VIEW)
OSCILLATOR
0.32VRF
9.2VRF
1ST AMPLIFIER
DE-BAND AMPLIFIER
Q101 M9322
Q106 M9552
12.6V
T104
WHT
P40
RF OUTPUT
F1
FREQ.1 SELECT
(YEL-BLK) F1 TO (P6-E2)
C116 .002UF
F2
FREQ.2 SELECT
(YEL-RED) F2 TO (P6-E3)
C117 .002UF
F3
FREQ.3 SELECT
(YEL-BRN) F3 TO (P6-F2)
C118 .002UF
F4
FREQ.4 SELECT
(YEL-BLU) F4 TO (P6-F3)
C119 .002UF
CHANNEL ELEMENTS
C120 820
R101 180
C121 82
R102 15K
R103 3.3K
R104 330
C123 82
L120
R133 2.7
C158 .0015 UF
C157 .05UF
L121 2.6
C122 .05UF
8.8V
C160
R134 33K
CR106
C159 .01UF
WHT-ORG
METER 3
(TO J21-3)
METER SOCKET DETAIL (REAR VIEW)
J21 METER SOCKET
BLK
BRN-RED
TO P6-A3
GROUND
TO P6-D2
FILTERED A+
WHT-BRN FROM MODULATOR
WHT-RED FROM DOUBLER Q105
WHT-ORG FROM AMPLIFIER Q106
WHT-GRN FROM POWER DOUBLER Q60
WHT-BLU FROM DRIVER Q603
RED P.A. METER (+) S601 (+)
BLU-WHT P.A. METER (-) S601(-)
YEL-GRN PUSH-TO-TALK P6-D3
MICROPHONE AUDIO LO P6-C3
MICROPHONE AUDIO HI P6-C2
(FROM P6-F1) OSC GND
BLK-BRN
(TO P6-E1) +8.8V REG
BRN-BLU
MICROPHONE AUDIO INPUT
GRN
HI
(FROM P6-C3) LO
R181 56
CR181
C181 0.1UF
C182 100UF
1ST AUDIO AMPLIFIER / CLIPPER
R182 1K
C183 15UF
R183 560
R184 6.8K
R186 2.7K
R187 820
C187 0.22 UF
R190 12K
R192 18K
NOTE 2
C184 .047 UF
Q181 M9570
CR182
CR183
R193 10K
L181 1000MH
C188 5000
R191 5.6K
C185 820
R188 56
R185 2.2K
R189 560
C186 22UF
TRANSMITTER AUDIO BOARD
E B C
TRANSISTOR DETAIL



Exciter RF Board TLE6392A

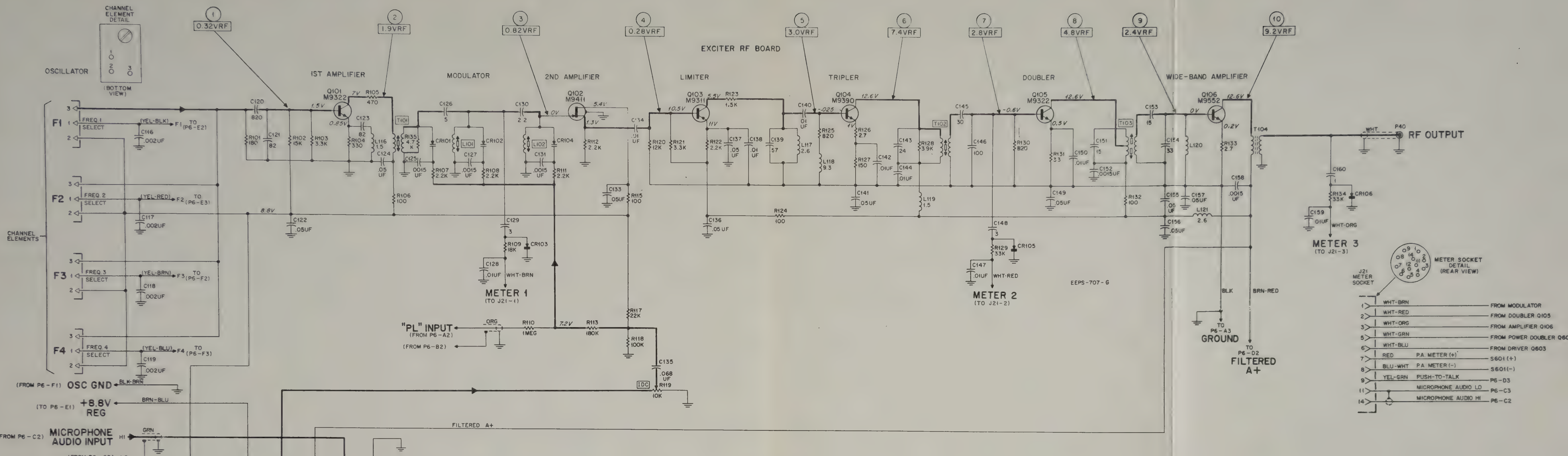
EXCITER-TRANSMITTER

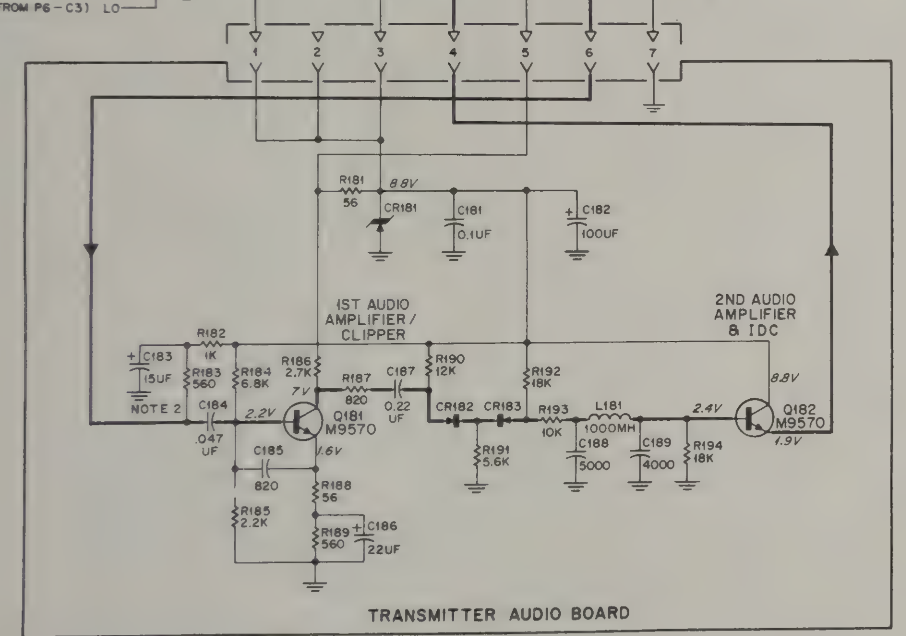
FOR MODELS TLE6392A-3 AND TLN8956A SUFFIX -1 OR LATER, REFER TO CIRCUIT BOARD DETAIL PEPS-3621.

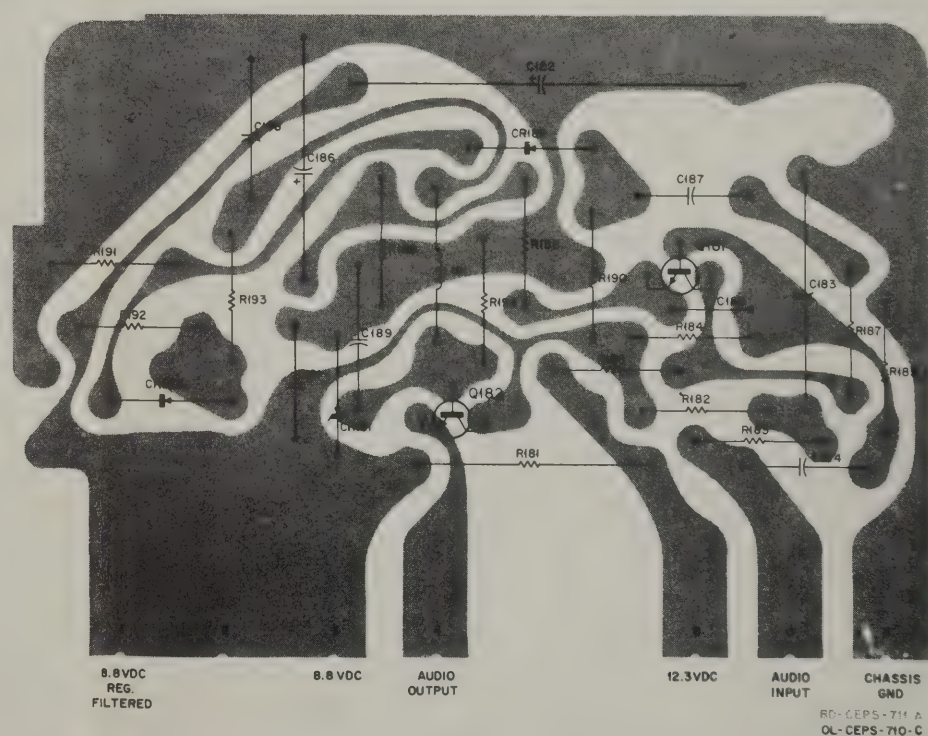
EPS-3627-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Exciter RF Board TLE6392A &
Transmitter Audio Board TLN8956A
Circuit Board Details
Motorola No. PEPS-714-F
2/7/73-UP







TRANSISTOR DETAIL

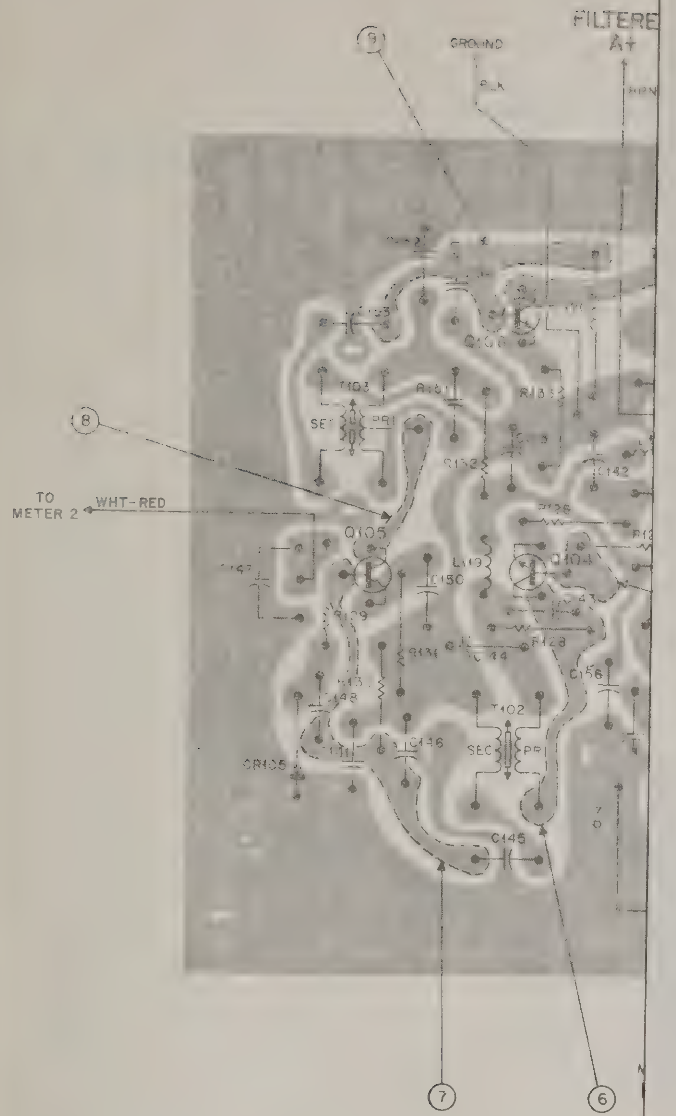
Transmitter Audio Board TLN8956A-1

CE	MOTOROLA PART NO	DESCRIPTION
		THERMISTOR
	6B82696B01	10K ±10% @ 25°C
		TRANSFORMER, RF
	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
	24C83380H01	bifilar winding
NON-REFERENCED ITEMS		
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

Transmitter Audio Board PL-369-O

		CAPACITOR, fixed.
	21C82372C01	0.1 uF +80-20%; 25 v
	23D82601A25	100 uF +150-10%; 20 v
	23D83214C02	15 uF ±20%; 25 v
	8D82905G03	.047 uF ±10%; 50 v
	21D82187B17	820 pF ±10%; 500 v
	23D83214C07	22 uF ±20%; 15 v
	8D83293B02	0.22 uF ±10%; 50 v
	21K863298	5000 pF ±1%; 500 v
	21K863396	4000 pF ±1%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
	48D82256C56	silicon; zener type
3	48C82392B03	silicon
		REACTOR:
	25D82113H02	a-f choke; 1000 mH
		TRANSISTOR: (SEE NOTE)
	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±10%; 1/4 w unl. stated
	6S2037	56
	6S127802	1K
	6S129620	560
	6S128687	6.8K
	6S128689	2.2K
	6S128688	2.7K
	6S129432	820
	6S129860	56
	6S129887	12K ±5%
	6S129982	5.6K ±5%
	6S131526	18K ±5%
	6S129668	10K ±5%

cement diodes and transistors must be ordered by
ola part number only for optimum performance.



EXCITER-TRANSMITTER

REVISIONS AND PARTS LIST
BACK OF THIS DIAGRAM

Board TLE6392A &
Audio Board TLN 8956A
rd Details
. PEPS-3621-F

REVISIONS

PEPS-714-F

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE6392A	Q104	WAS 48R869322 TYPE M9322	TRIPLER
	R123	WAS 6S129708; 1.2K	
	R125	WAS 6S129806; 330	
	R126	WAS 6S124B57; 3.3	
TLE6392A-1 TLE6392A-2	R135	ADDED; 6S128687 6.8K	T101 SECONDARY
TLE6392A-3 TLN8956A-3		PRINTED CIRCUIT BOARD PLATING REVISED.	REFER TO PEPS-3621

PARTS LIST

TLE6392A Exciter Board PL-368-B

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed
C116, 117, 118, 119	21D82428B25	.002 uF ±20%; 500 v
C120	21D82187B17	820 pF ±10%; 500 v
C121, 123	21D82610C20	82 pF ±5%; 200 v; NPO
C122, 124, 132, 133, 136, 137, 149, 155, 156, 157	21C82372C04	.05 uF +80-20%, 25 v
C125, 127, 131, 152, 158	21D82187B18	1500 pF ±10%; 100 v
C126, 129, 148	21K868935	3 pF ±0.25 pF; 2000 v; NPO
C128, 134, 138, 140, 141, 142, 144, 147, 150, 159	21D82428B59	.01 uF +80-20%, 200 v
C130	21D82133G40	3.9 pF ±0.25 pF; 500 v; NPO
C135	8C82095G04	.068 uF ±10%; 200 v
C139	21D82610C47	57 pF ±5%; 100 v; N220
C143	21D82133G74	24 pF ±5%; 500 v; N150
C145	21D82610C14	30 pF ±5%; 200 v; N150
C146	21D82610C44	100 pF ±5%; 100 v; N220
C151, 153	21S114535	15 pF ±5%; 500 v; N150
C154	21K855809	33 pF ±5%; 250 v; N150
C160	21K864518	1 pF ±10%; 500 v
		SEMICONDUCTOR DEVICE, diode (SEE NOTE)
CR101, 102, 104	48D82190H08	silicon; varicap; type MV1662
CR103, 105, 106	48C82139G01	germanium
		COIL, RF
L101, 102	24D83377H01	coded RED; incl. 76B83377H01 CORE, tuning
L116, 119	24C82835G04	choke; 1.5 uH
L117, 121	24C82835G03	choke; 2.6 uH
L118	24C82835G20	choke; 9.3 uH
L120	24B83977B01	incl. ferrite body
		CONNECTOR, plug
P40	28B82331G01	male; coaxial; min; "cinch" type
		TRANSISTOR (SEE NOTE)
Q101, 105	48R869322	N-P-N; type M9322
Q102	48R869411	field-effect, type M9411
Q103	48R869311	P-N-P; type M9311
Q104	48R869390	N-P-N; type M9390
Q106	48R869552	N-P-N; type M9552; does not incl. 26B83379H01 HEAT SINK
		RESISTOR, fixed ±10%; 1/4 w; unl. stated
R101	6S129662	180
R102	6S127805	15K
R103, 121	6S129231	3.3K
R104	6S129775	330
R105, 122	6S127801	470
R106, 115, 124, 132	6S129753	100
R107, 108, 111	6S128689	2.2K
R109	6S128904	18K
R110	6S129189	1 meg ±5%
R112	6S129806	330 ±5%
R113	6S124B04	180K ±5%
R114	6S129235	1.2K
R116	6S129236	15K ±5%
R117	6S129667	22K ±5%
R118	6S124A97	100K ±5%
R119	18D82238D15	var. 10K
R120	6S129230	12K
R123	6S129681	1.5K ±5%
R125	6S129818	820 ±5%
R126, 133	6S124B55	2.7 ±5%
R127	6S129862	150
R128	6S129819	3.9K ±5%
R129, 134	6S127807	33K
R130	6S129432	820
R131	6S129754	33
R135	6S128687	6.8K

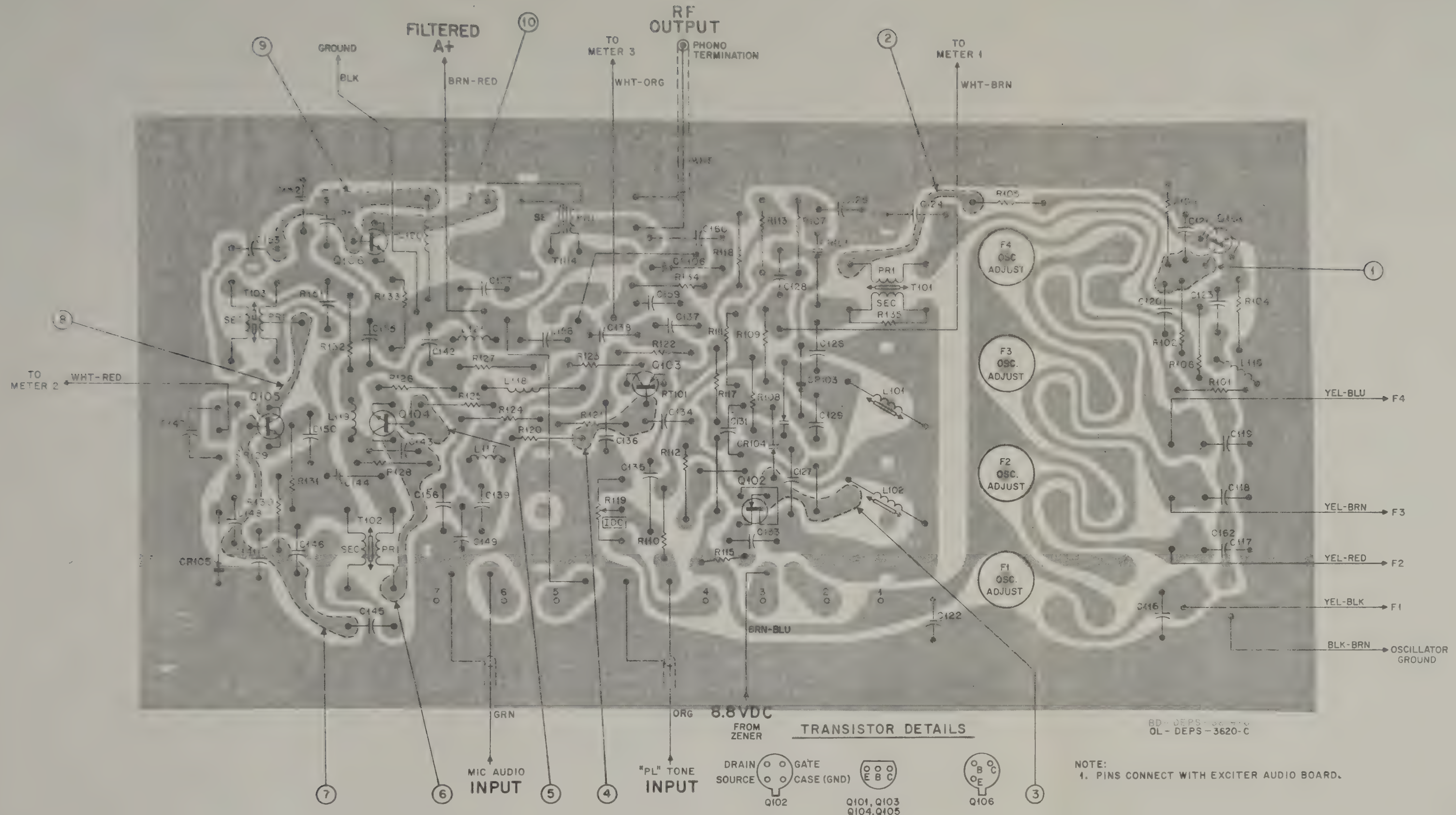
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		THERMISTOR
RT101	6B82696B01	10K ±10% @ 25°C
		TRANSFORMER, RF
T101	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
T102	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
T103	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
T116	24C83380H01	bifilar winding
		NON-REFERENCED ITEMS
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

TLN8956A Transmitter Audio Board PL-369-O

		CAPACITOR, fixed:
C181	21C82372C01	0.1 uF +80-20%; 25 v
C182	23D82601A25	100 uF +150-10%; 20 v
C183	23D83214C02	15 uF ±20%; 25 v
C184	8D82905G03	.047 uF ±10%; 50 v
C185	21D82187B17	820 pF ±10%; 500 v
C186	23D83214C07	22 uF ±20%; 15 v
C187	8D83293B02	0.22 uF ±10%; 50 v
C188	21K863298	5000 pF ±1%; 500 v
C189	21K863396	4000 pF ±1%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR181	48D82256C56	silicon; zener type
CR182, 183	48C82392B03	silicon
		REACTOR:
L181	25D82113H02	a-f choke; 1000 mH
		TRANSISTOR: (SEE NOTE)
Q181, 182	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±10%; 1/4 w unl. stated
R181	6S2037	56
R182	6S127802	1K
R183, 189	6S129620	560
R184	6S128687	6.8K
R185	6S128689	2.2K
R186	6S128688	2.7K
R187	6S129432	820
R188	6S129860	56
R190	6S129887	12K ±5%
R191	6S129982	5.6K ±5%
R192, 194	6S131526	18K ±5%
R193	6S129668	10K ±5%

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



Exciter RF Board TLE6392A-4

FOR MODELS TLE6392A-1 & 2
AND TLN8956A WITH NO SUFFIX,
REFER TO CIRCUIT BOARD DETAIL
PEPS-714.

EPS-3628-A

EXCITER-TRANSMITTER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

Exciter RF Board TLE6392A &
Transmitter Audio Board TLN 8956A
Circuit Board Details
Motorola No. PEPS-3621-F
2/7/73-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER, RF:
T101	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
T102	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
T103	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
T116	24C83380H01	bifilar winding
	NON-REFERENCED ITEMS	
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

TLN8956A Transmitter Audio Board PL-369-O

		CAPACITOR, fixed:
C181	21C82372C01	0.1 uF +80-20%; 25 v
C182	23D82601A25	100 uF +150-10%; 20 v
C183	23D83214C02	15 uF ±20%; 25 v
C184	8D82905G03	.047 uF ±10%; 50 v
C185	21D82187B17	820 pF ±10%; 500 v
C186	23D83214C07	22 uF ±20%; 15 v
C187	8D83293B02	0.22 uF ±10%; 50 v
C188	21K863298	5000 pF ±1%; 500 v
C189	21K863396	4000 pF ±1%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR181	48D82256C56	silicon; zener type
CR182, 183	48C82392B03	silicon
		REACTOR:
L181	25D82113H02	a-f choke; 1000 mH
		TRANSISTOR: (SEE NOTE)
Q181, 182	48R869570	N-P-N; type M9570 .
		RESISTOR, fixed: ±10%; 1/4 w unl. stated
R181	6S2037	56
R182	6S127802	1K
R183, 189	6S129620	560
R184	6S128687	6.8K
R185	6S128689	2.2K
R186	6S128688	2.7K
R187	6S129432	820
R188	6S129860	56
R190	6S129887	12K ±5%
R191	6S129982	5.6K ±5%
R192, 194	6S131526	18K ±5%
R193	6S129668	10K ±5%

NOTE:

Replacement diodes and transistors must be ordered by Motorola ·art number only for optimum performance.

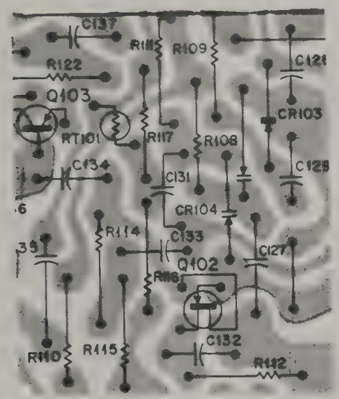
POWER AMPLIFIER ALIGNMENT

STEP	ADJUSTMENT	METER READING	PROCEDURE
1	Hi-Voltage On-Off Switches	1 or 2	Set Hi-voltage on-off switches, accessible with front door open, to ON position.
2	Driver Amplifier Screen Voltage (Knob)		Rotate screen voltage pot R6 on the Driver Amplifier to the maximum ccw position.
3	Power Amplifier SCREEN VOLTAGE (knob)		Rotate screen voltage pot R4 on the Power Amplifier to the maximum ccw position.
4	Ant. Coupling Loop, L1 (knob)	Dip on Wattmeter	Key test set briefly and decouple the antenna for lowest possible reading on wattmeter.
5	Plate Tuning Control, Z1	Dip on Amplifier Plate Meters (Upper & Lower)	Key test set. Use ordinary metallic screwdriver to tune Z1 for dip reading on plate current meters. Dip should occur when tuning slot is more than 30° from vertical or horizontal positions. If dip does not occur within this range, refer to tuning procedure for Z2 and Z3.
6	Ant. Coupling Loop, L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
7	Grid Tuning Controls, C1 & C2	Peak on Amplifier Grid Meter and Balance on Amplifier Plate Meters	Use ordinary metallic screwdriver. Tune C1 and C2 for maximum (peak) reading on amplifier grid meter and equal meter readings on the amplifier plate meters.
8	Plate Tuning Control, Z1	Dip on Amplifier Plate Meter (Upper & Lower)	Tune Z1 for dip on amplifier plate meters. Note reading on each meter. If meter readings differ retune C1 and C2 to equalize readings. C1 tunes upper amplifier, C2 tunes lower. Balance meter readings by tuning to mid-point of original readings noted. Recheck Z1 for dip on each meter when balanced. NOTE Tuning C1 will have an effect on the plate current readings for both final tubes. One reading will increase while the other decreases. Tuning C2 will reverse this situation. By careful adjustment of C1 and C2, the plate currents can be perfectly balanced.
9	Ant. Coupling Loop L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
10	SCREEN VOLTAGE (knob)	200 mA on Amplifier Plate Meters (Upper & Lower)	Rotate control clockwise until amplifier plate current meter reads 200 mA.
11	Final Amplifier Ant. Coupling Loop L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
12	Grid Tuning Controls C1 and C2	Amplifier Grid Meter Peak between 15 and 40 mA.	Retune grid tuning controls, C1 and C2, for peak reading on amplifier grid meter. Reading should be between 35 and 40 mA.

REVISIONS

PEPS-3621-F

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE6392A-4	C125, 131	FROM 21D82187B18, 1500 pF TO 21D84226B63, 1500 pF	2ND AMPL.
	C127	FROM 21D82187B11, 1500 pF TO 21D84226B63, 1500 pF	
	C126	FROM 21K868935, 3 pF TO 21D83406D65, 5 pF	
	C130	FROM 21D82133G40, 3.9 pF TO 21D82204B26, 2.2 pF	
	C132	REMOVED 21C82372C04, .05 uF	
	R114	REMOVED 6S129235, 1.2k	
	R112	FROM 6S129806, 330 TO 6S129804, 2.2k	
	R122	FROM 6S127801, 470 TO 6S129804, 2.2k	
	R135	FROM 6S127687, 6.8k TO 6S127804, 4.7k	
	R115	FROM 6S129753, 100; 1/4 W TO 6S185B67, 100; 1/8 W	
	R116	REMOVED 6S129236, 15k	
	RT101	REMOVED 6B82696B01 10k	
	CR101, 102, 104	FROM 48D82190H08, MV1662 TO 48D82190H17, SMV489	
		CIRCUIT WAS AS SHOWN BELOW:	



PARTS LIST

TLE6392A Exciter Board PL-368-F

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C116, 117, 118, 119	21D82428B25	.002 uF ±20%; 500 v
C120	21D82187B17	820 pF ±10%; 500 v
C121, 123	21D82610C20	82 pF ±5%; 200 v; NP0
C122, 124, 133, 136, 137, 149, 155, 156, 157	21C82372C04	.05 uF +80-20%; 25 v
C125, 127, 131	21D84426B63	1500 pF ±5%; 500 v
C126	21D83406D65	5 pF ±5%; 500 v; NP0
C128, 134, 138, 140, 141, 142, 144, 147, 150, 159	21D82428B59	.01 uF +80-20%; 200 v
C129, 148	21K868935	3 pF ±0.25 pF; 2000 v; NP0
C130	21D82204B26	2.2 pF ±0.1 pF; 500 v; NP0
C135	8C82095G04	.068 uF ±10%; 200 v
C139	21D82610C47	57 pF ±5%; 100 v; N220
C143	21D82133G74	24 pF ±5%; 500 v; N150
C145	21D82610C14	30 pF ±5%; 200 v; N150
C146	21D82610C44	100 pF ±5%; 100 v; N220
C151, 153	21S114535	15 pF ±5%; 500 v; N150
C152, 158	21D82187B18	1500 pF ±10%; 100 v
C154	21K855809	33 pF ±5%; 250 v; N150
C160	21K864518	1 pF ±10%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101, 102, 104	48D82190H17	silicon; varicap; type SMV489
CR103, 105, 106	48C82139G01	germanium
		COIL, RF:
L101, 102	24D83377H01	coded RED; incl. 76B83377H01 CORE, tuning
L116, 119	24C82835G04	choke; 1.5 uH
L117, 121	24C82835G03	choke; 2.6 uH
L118	24C82835G20	choke; 9.3 uH
L120	24B83977B01	incl. ferrite body
		CONNECTOR, plug:
P40	28B82331G01	male; coaxial; min; "cinch" type
		TRANSISTOR: (SEE NOTE)
Q101, 105	48R869322	N-P-N; type M9322
Q102	48R869411	field-effect; type M9411
Q103	48R869311	P-N-P; type M9311
Q104	48R869390	N-P-N; type M9390
Q106	48R869552	N-P-N; type M9552; does not incl. 26B83379H01 HEAT SINK
		RESISTOR, fixed: ±10%; 1/4 w; unl. stated
R101	6S129662	180
R102	6S127805	15K
R103, 121	6S129231	3.3K
R104	6S129775	330
R105,	6S127801	470
R106, 124, 132	6S129753	100
R107, 108, 111	6S128689	2.2K
R109	6S128904	18K
R110	6S129189	1 meg ±5%
R112, 122,	6S129804	2.2K ±5%
R113	6S124B04	180K ±5%
R115	6S185B67	100; 1/8 w
R117	6S129667	22K ±5%
R118	6S124A97	100K ±5%
R119	18D82238D15	var: 10K
R120	6S129230	12K
R123	6S129681	1.5K ±5%
R125	6S129818	820 ±5%
R126, 133	6S124B55	2.7 ±5%
R127	6S129862	150
R128	6S129819	3.9K ±5%
R129, 134	6S127807	33K
R130	6S129432	820
R131	6S129754	33
R135	6S127804	4.7K

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER, RF:
T101	24D83377H02	coded BRN; incl. 76B83382H01 CORE, tuning
T102	24D83377H05	coded ORG; incl. 76B83382H03 CORE, tuning
T103	24D83377H03	coded YEL; incl. 76B83382H02 CORE, tuning (2 cores req'd)
T116	24C83380H01	bifilar winding
	NON-REFERENCED ITEMS	
	1V80737A35	SHIELD, coil: used with L101, L102, T101, T102, T103
	26A84000A01	SHIELD, coil: used with T116

TLN8956A Transmitter Audio Board PL-369-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C181	21C82372C01	0.1 uF +80-20%; 25 v
C182	23D82601A25	100 uF +150-10%; 20 v
C183	23D83214C02	15 uF ±20%; 25 v
C184	8D82905G03	.047 uF ±10%; 50 v
C185	21D82187B17	820 pF ±10%; 500 v
C186	23D83214C07	22 uF ±20%; 15 v
C187	8D83293B02	0.22 uF ±10%; 50 v
C188	21K863298	5000 pF ±1%; 500 v
C189	21K863396	4000 pF ±1%; 500 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR181	48D82256C56	silicon; zener type
CR182, 183	48C82392B03	silicon
		REACTOR:
L181	25D82113H02	a-f choke; 1000 mH
		TRANSISTOR: (SEE NOTE)
Q181, 182	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±10%; 1/4 w unl. stated
R181	6S2037	56
R182	6S127802	1K
R183, 189	6S129620	560
R184	6S128687	6.8K
R185	6S128689	2.2K
R186	6S128688	2.7K
R187	6S129432	820
R188	6S129860	56
R190	6S129887	12K ±5%
R191	6S129982	5.6K ±5%
R192, 194	6S131526	18K ±5%
R193	6S129668	10K ±5%

NOTE:

Replacement diodes and transistors must be ordered by Motorola .art number only for optimum performance.

POWER AMPLIFIER ALIGNMENT

STEP	ADJUSTMENT	METER READING	PROCEDURE
1	Hi-Voltage On-Off Switches	1 or 2	Set Hi-voltage on-off switches, accessible with front door open, to ON position.
2	Driver Amplifier Screen Voltage (Knob)		Rotate screen voltage pot R6 on the Driver Amplifier to the maximum ccw position.
3	Power Amplifier SCREEN VOLTAGE (knob)		Rotate screen voltage pot R4 on the Power Amplifier to the maximum ccw position.
4	Ant. Coupling Loop, L1 (knob)	Dip on Wattmeter	Key test set briefly and decouple the antenna for lowest possible reading on wattmeter.
5	Plate Tuning Control, Z1	Dip on Amplifier Plate Meters (Upper & Lower)	Key test set. Use ordinary metallic screwdriver to tune Z1 for dip reading on plate current meters. Dip should occur when tuning slot is more than 30° from vertical or horizontal positions. If dip does not occur within this range, refer to tuning procedure for Z2 and Z3.
6	Ant. Coupling Loop, L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
7	Grid Tuning Controls, C1 & C2	Peak on Amplifier Grid Meter and Balance on Amplifier Plate Meters	Use ordinary metallic screwdriver. Tune C1 and C2 for maximum (peak) reading on amplifier grid meter and equal meter readings on the amplifier plate meters.
8	Plate Tuning Control, Z1	Dip on Amplifier Plate Meter (Upper & Lower)	Tune Z1 for dip on amplifier plate meters. Note reading on each meter. If meter readings differ retune C1 and C2 to equalize readings. C1 tunes upper amplifier; C2 tunes lower. Balance meter readings by tuning to mid-point of original readings noted. Recheck Z1 for dip on each meter when balanced. NOTE Tuning C1 will have an effect on the plate current readings for both final tubes. One reading will increase while the other decreases. Tuning C2 will reverse this situation. By careful adjustment of C1 and C2, the plate currents can be perfectly balanced.
9	Ant. Coupling Loop L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
10	SCREEN VOLTAGE (knob)	200 mA on Amplifier Plate Meters (Upper & Lower)	Rotate control clockwise until amplifier plate current meter reads 200 mA.
11	Final Amplifier Ant. Coupling Loop L1 (knob)	Peak on Wattmeter	Couple the antenna for maximum reading.
12	Grid Tuning Controls C1 and C2	Amplifier Grid Meter Peak between 15 and 40 mA.	Retune grid tuning controls, C1 and C2, for peak reading on amplifier grid meter. Reading should be between 35 and 40 mA.

POWER AMPLIFIER ALIGNMENT (CONT'D)

STEP	ADJUSTMENT	METER READING	PROCEDURE
13	CAUTION DO NOT ADJUST FOR MORE THAN 600 WATTS INPUT. (SEE STEP 10.) NOTE STEPS 7, 8, 9, 10, 11 AND 12 COMPRISE A SEQUENCE OF ADJUSTMENTS WHICH INTERACT UPON EACH OTHER. IF, UPON COMPLETION OF STEP 12 FINAL READINGS DO NOT AGREE WITH THE TABLE AT THE END OF THESE INSTRUCTIONS, REPEAT STEPS 7 THRU 12 TWICE MORE. IF CORRECT READINGS ARE STILL NOT OBTAINED, PROCEED TO CONCLUDING ADJUSTMENTS. PLATE TUNING CONTROL Z1 MUST BE ADJUSTED WITH SCREEN VOLTAGE AT MINIMUM (COUNTERCLOCKWISE). ANTENNA COUPLING LOOP L1 MUST BE ADJUSTED AFTER EACH ADJUSTMENT OF SCREEN VOLTAGE.		

CC4101C 600 WATT INPUT POWER TABLE		CC4101CF 550 WATT INPUT POWER TABLE
Plate Voltage (volts)	Plate Current Per Tube (milliamperes)	Plate Current Per Tube (milliamperes)
1800	165	153
1700	176	162
1600	187	172
1500	200	184
1400	214	196
1300	230	212
1200	250	228

CONCLUDING ADJUSTMENTS

1. Interaction between grid and plate circuits may require slight compensating adjustments of the PLATE TUNING control, Z1, as the GRID TUNING controls, C1 and C2, are adjusted. Increasing the grid current may decrease the plate current; decreasing the grid current increases the plate current. When finally adjusted, the plate power input should be a maximum of 300 watts for each amplifier tube as read on the two AMPLIFIER PLATE voltage and current meters.

2. If the grid current is less than 15 mA as read on the AMPLIFIER GRID meter, increase the rf drive from the driver station by adjusting the driver station SCREEN VOLTAGE CONTROL, for increased reading on the AMPLIFIER GRID meter. Then readjust the AMPLIFIER GRID tuning controls for maximum AMPLIFIER GRID meter reading in the 35-40 mA range. Adjust controls to equalize readings on the two AMPLIFIER PLATE current meters as in step 8. POWER AMPLIFIER ALIGNMENT. With balanced readings readjust PLATE TUNING control, Z1, and COUPLING knob, L1, for maximum of 600 watts input.

3. If the grid current is more than 40 mA as read on the AMPLIFIER GRID meter, decrease the rf driver from the exciter by adjusting the driver station SCREEN VOLTAGE CONTROL, for decreased reading on the AMPLIFIER GRID meter. Then readjust the AMPLIFIER GRID tuning controls for maximum AMPLIFIER GRID meter reading in the 15-40 mA range. Adjust controls to equalize readings on the two AMPLIFIER PLATE current meters as in step 8. POWER AMPLIFIER ALIGNMENT. With balanced readings readjust PLATE TUNING control, Z1, and COUPLING knob, L1, for maximum of 600 watts input.

4. If final readings on AMPLIFIER PLATE current meters cannot be brought up to full loading (600 watts), rotate the SCREEN VOLTAGE control clockwise.

ALIGNMENT CONTINUED ON BACK

NOTE

As tubes age and the power output drops it is possible to again increase this power output by increasing the screen voltage.

As tubes age further, the balancing of plate current may not be possible, however, if the imbalance is greater than 50 mA the tubes should be replaced.

CAUTION

DO NOT ADJUST TRANSMITTER FOR MORE THAN 600 WATTS POWER INPUT. POWER INPUT (WATTS) = PLATE VOLTAGE X TOTAL PLATE CURRENT (upper + lower AMPLIFIER PLATE meter readings)

FINAL METER READINGS

DRIVER STATION FINAL AMPLIFIER POSITION 6	DRIVER STATION FINAL AMPLIFIER POSITION 7	POWER AMPLIFIER GRID	POWER AMPLIFIER PLATE (UPPER)	POWER AMPLIFIER PLATE (LOWER)	POWER AMPLIFIER PLATE VOLTAGE
25-30	10-18	15-40	SEE 600 WATT INPUT POWER TABLE		

TUNING PROCEDURE FOR Z2 AND Z3

1. When to Tune Z2 and Z3. Z2 and Z3 are coarse tuning adjustments in the power amplifier plate current. They are used to bring the resonant point into the tuning range of the fine tuning control, Z1. When no dip can be found by tuning Z1 or when the dip is near the vertical or horizontal position of the tuning slot, Z2 and Z3 must be adjusted.

2. How to Locate Z2 and Z3

a. Turn HI-VOLTAGE switch OFF (accessible from the front of the cabinet).

b. Remove the two "Phillips" head screws on the right side of the power amplifier which hold the right side of the final amplifier to the mounting rack.

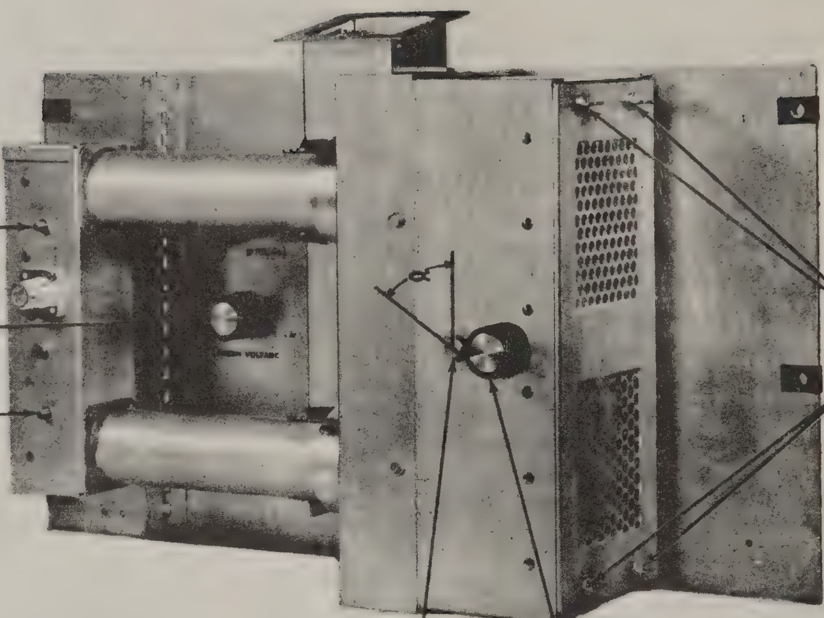
c. Open the rear door.

d. Swing the amplifier back on its hinges.

e. Release the four 1/4-turn thumb-screws which hold the cover plate on the side of the chassis and remove the plate to expose the end of the cavity.

f. Z2 and Z3 are "U-shaped" shorting bars which slide toward and away from the center of the cavity. Z2 is the top bar, Z3 is the lower one.

3. How to Tune Z2 and Z3. Move BOTH shorting bars approximately 1/8-inch toward or away from the center of the cavity; Z2 and Z3 should always be set at equal distances from the center of the cavity. When Z1 dips the meter near the VERTICAL position, move Z2 and Z3 TOWARD the center of the cavity. When Z1 dips the meter near the HORIZONTAL position, move Z2 and Z3 AWAY FROM the center of the cavity. IF NO DIP IS FOUND when Z1 is tuned through its full range, it will be a matter of trial and error positioning of Z2 and Z3. Start with Z2 and Z3 positioned midway in their length of travel. It may be necessary to adjust the shorting bars four or more times before a dip reading falls within the tuning range of Z1. If the operating frequency is in the lower portion of the 450-470 MHz band, move the shorting bars away from the center of the cavity. If the transmitter is operating in the upper portion of the band, move the bars toward the center of the cavity. Replace the final amplifier chassis by reversing the procedure in step 2. Check the tuning of Z1. If Z1 still does not dip the meters as prescribed in step 3 of POWER AMPLIFIER ALIGNMENT, adjust Z2 and Z3 again until the proper dip is found, then go on to step 4 of POWER AMPLIFIER ALIGNMENT.



NOTES:

1. C1, C2 & Z1 ARE SCREWDRIVER ADJUSTMENTS.
2. $\propto$ SHOULD BE BETWEEN 30° AND 45° WHEN Z1 IS TUNED FOR DIP READING.

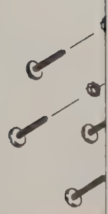
AEPD-21371-O

PARTS LIST

CODE	MOT PAR
1	26B8
2	14B8
3	4B82
4	
6	1V80
7	36A8
8	
9	29B8
10	
11	42-8
12	37A8
13	3B83
14	
15	37C8
16	15B8
17	55A8
18	32A8
19	**4A84
20	**14A8
21	**2A81
22	**24B8
23	**4C87
	**15B8
24	**47A8
	**47C8
25	**14A8
*26	3A83
27	58D8
28	
29	
30	
31	42D8
32	55A8
33	
34	
35	
36	1V80
37	47B8
38	21D8
	42A8
39	24B8
40	3S81
41	43B8
42	76A8
43	58B8
44	46A8
45	3S71
46	36B8
47	32-8

NOTES·

*See Electrical
**Part of Harmo
It is recomme
replaced.



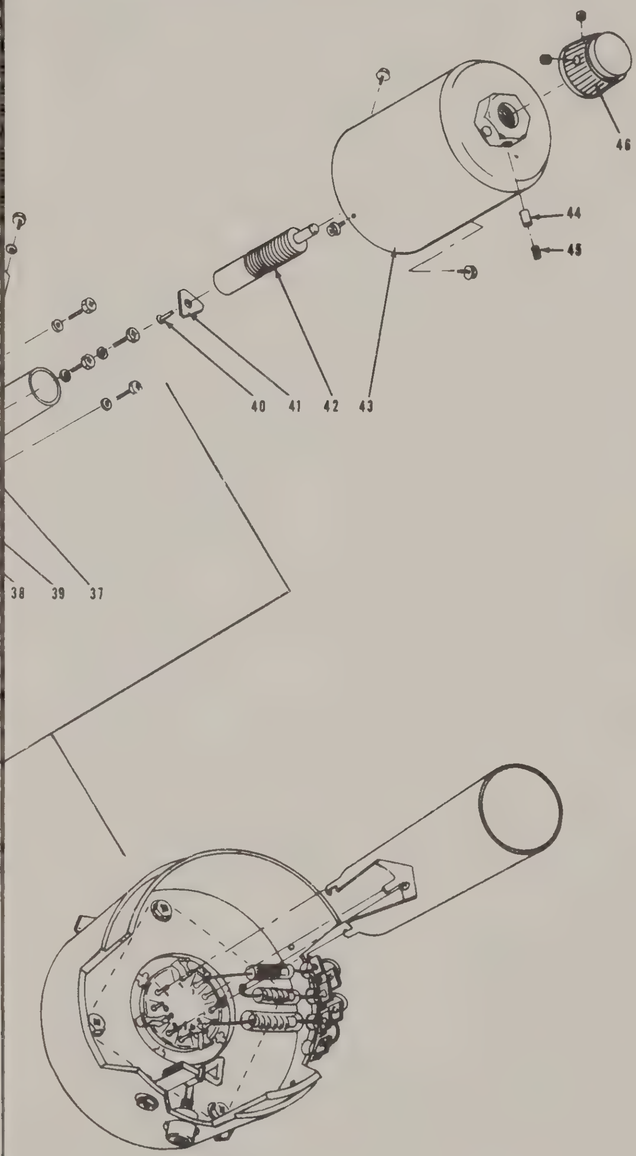
manual revision SMR-1558A

For Instruction Manuals

8P81002E30-A	68P81002E35-A
8P81002E40-A	68P81002E45-C
8P81006E60-A	68P81006E70-A
8P81011E70-O	68P81011E75-A
8P81011E80-O	68P81011E85-O
8P81056A30-A	68P81056A35-A

SE STATIONS and REPEATER (RT) STATIONS

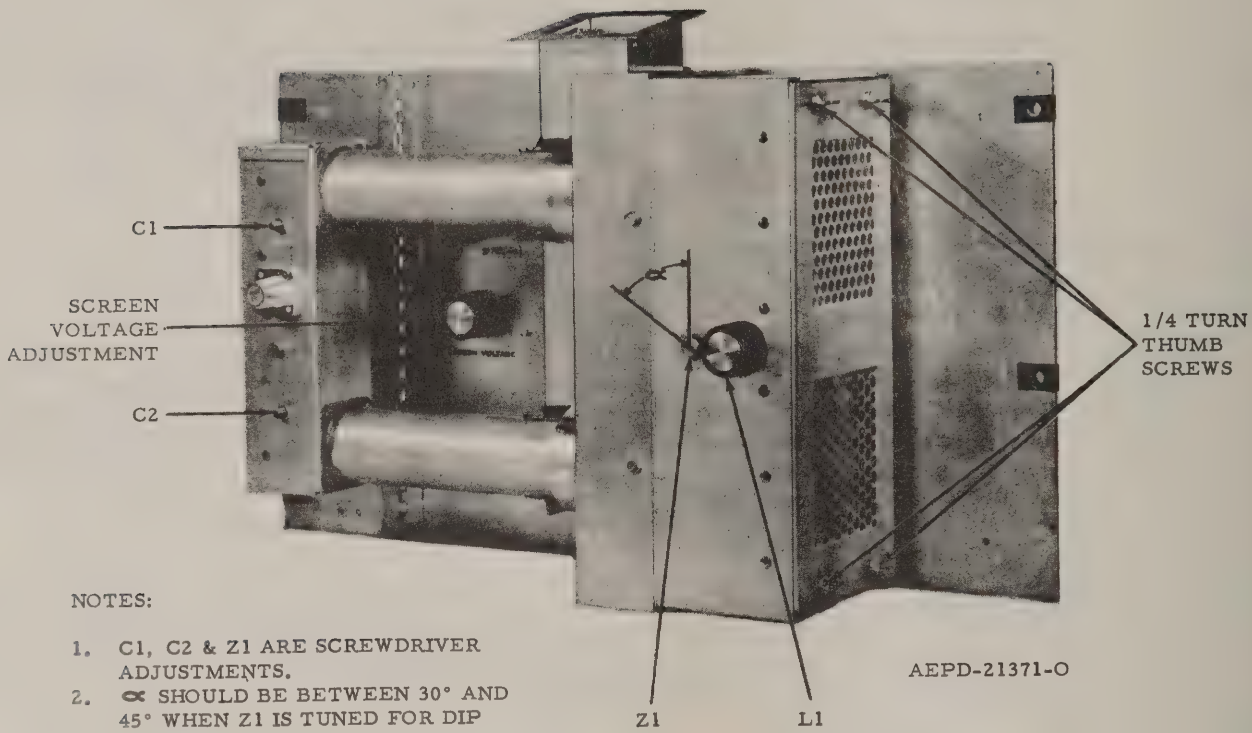
l Parts Detail DEPS-2758 with this Detail PEPS-2758-D.



DEPS-2758-D

TLE1060B POWER AMPLIFIER

Power Amplifier Cavity
Mechanical Parts Detail
Motorola No. DEPS-2758-D
2/9/73-UP



NOTES:

1. C1, C2 & Z1 ARE SCREWDRIVER ADJUSTMENTS.
2. α SHOULD BE BETWEEN 30° AND 45° WHEN Z1 IS TUNED FOR DIP READING.

AEPD-21371-O

PARTS LIST

PL-672-C

CODE	MOTOROLA PART NO.	DESCRIPTION
1	26B83909G01	HEAT SINK
2	14B83906G01	INSULATOR
3	4B82345A11	SHOULDER WASHER
4	*	PLATE LINE
6	1V80706B72	PLATE LINE CLAMP ASSY
7	36A83984G02	PLATE TUNING KNOB
8	*	RF CHOKE (L5)
9	29B83988G01	FEED THRU TERMINAL
10		NOT USED
11	42-83229F01	RETAINING CLIP
12	37A83173H01	"TEFLON" INSULATOR
13	3B83908G01	PLATE TUNING SCREW
14	*	DISC CAPACITOR (C14)
15	37C82633B09	RUBBER GROMMET
16	15B83992G01	FEED THRU COVER
17	55A879705	DRAW-PULL CATCH
18	32A83384H01	HOUSING SHIM
19	**4A84401A01	SPECIAL WASHER
20	**14A84400A01	COUPLING LOOP INSULATOR
21	**2A83383H01	NUT
22	**24B83996G01	OUTPUT COUPLING LOOP
23	**4C82414E06	SPRING WASHER
24	**15B83997G01 **47A82427E03 **47C83028H01	HARMONIC FILTER
25	**14A83191H01	INSULATOR SPACER
*26	3A83907G01	PLUG SCREW
27	58D83985G01	PLATE CAVITY
28	*	TUBE (V1)
29	*	SCREEN BYPASS CAPACITOR (C11)
30	*	TUBE SOCKET (XV1)
31	42D83995G01	SOCKET MOUNTING RING
32	55A83990G01	STRIKE
33	*	RF CHOKE (L4)
34	*	RF CHOKE (L2)
35	*	RF CHOKE (L3)
36	1V80781A71	CAPACITORS AND MTG ASSY
37	47B83989G01	GRID LINE
38	21D82785H16 42A82765C03	CAPACITOR AND BRACKET (C-13)
39	24B83987G01	GRID COUPLING LOOP
40	3S8154	DRIVE SCREW
41	43B83904G01	"TEFLON" SPACER
42	76A83905G01	GRID TUNING SLUG
43	58B83993G01	GRID CAVITY
44	46A852210	"TEFLON" INSERT
45	3S7148	SET SCREW
46	36B83579B01	CONTROL KNOB
47	32-84045E01	METAL KNIT GASKET

NOTES:

*See Electrical Parts List
**Part of Harmonic Filter Assembly, 1V80781A75. It is recommended that the entire assembly be replaced.

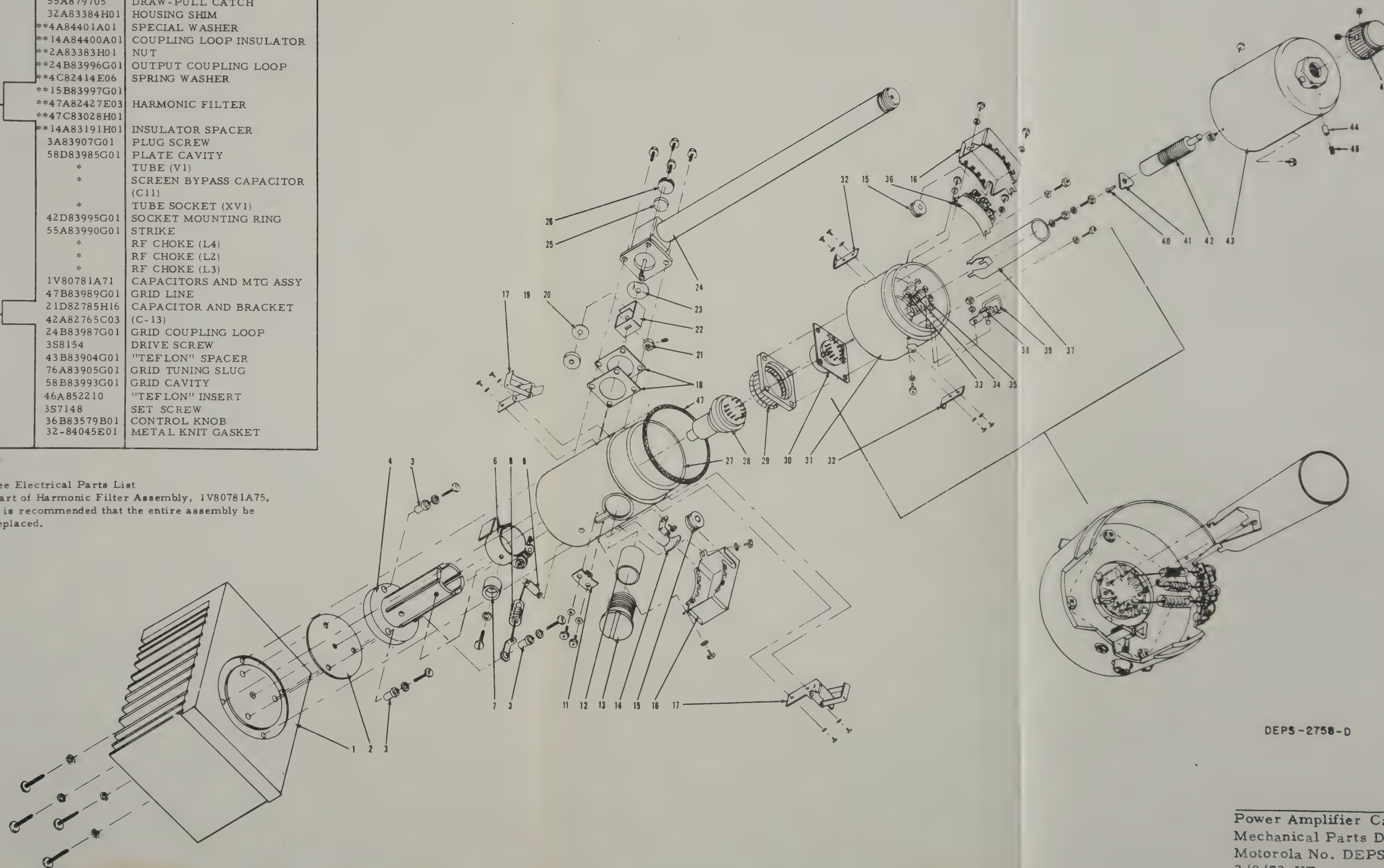
instruction manual revision SMR-1558A

For Instruction Manuals

68P81002E30-A 68P81002E35-A
68P81002E40-A 68P81002E45-C
68P81006E60-A 68P81006E70-A
68P81011E70-O 68P81011E75-A
68P81011E80-O 68P81011E85-O
68P81056A30-A 68P81056A35-A

450-470 MHz BASE STATIONS and REPEATER (RT) STATIONS

Replace Mechanical Parts Detail DEPS-2758 with this Detail PEPS-2758-D.



DEPS-2758-D

Power Amplifier Cavity
Mechanical Parts Detail
Motorola No. DEPS-2758-D
2/9/73-UP

TLE1060B POWER AMPLIFIER

TRANSMITTER PRE-ALIGNMENT NOTES

A. EXCERPTS FROM FCC REGULATIONS

FCC Regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.
2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and the local conditions.
3. Frequency and deviation of a transmitter must be checked before it is placed in service and rechecked once each year thereafter.

B. TEST EQUIPMENT REQUIRED

1. Built-in metering facilities or Motorola Model S1056A-9A Portable Test Set with a Motorola Model TKN6025A Adapter Cable (available on separate order). A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available.
2. Motorola Model TLN8805A Tuning Tool Kit.
3. Motorola Model T1013A RF Load Resistor (or equivalent) and Model 43 Bird "Thruline" Wattmeter with 100-watt element (or equivalent).
4. Digital Frequency Meter S1075B or Digital Frequency Meter and Deviation Monitor S1078B.

C. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

1. Set function selector switch to XMTR position.
2. Place the oscillator and meter reversing switch in the OFF position.
3. Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the transmitter metering socket. When the test set is not being used, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.

D. HOW TO KEY THE TRANSMITTER

1. Connect the load resistor and "Thruline" wattmeter to the exciter-transmitter output.
2. Key the transmitter with the microphone push-to-talk switch or the KEY XMTR switch on the test set.

<u>CAUTION</u>

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Current is excessive in untuned stages and may cause damage. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

E. FREQUENCY CALCULATIONS

$$\text{xtal freq. in MHz} \longrightarrow f_o = \frac{f_c}{36} \longleftarrow \text{carrier freq. in MHz}$$

F. "IDC" CONTROL SETTING
(Transmitter Deviation)

Refer to the separate IDC Adjustment Procedure for setting of the IDC control.

G. PRE-ALIGNMENT STATION SWITCH POSITION CHART

CHASSIS	CONTROL	POSITION
RF Power Amplifier	HIGH VOLTAGE SWITCH	Off
	SCREEN VOLTAGE	Fully Counterclockwise
	PLATE TUNING SCREW	Fully Clockwise
	GRID TUNING KNOB	Fully Counterclockwise

H. TRANSMITTER ALIGNMENT PROCEDURE

NOTE

(a) This tuning procedure must be followed exactly whenever tuning is required. When the power amplifier tube is replaced, set station switch to positions as given in the Pre-Alignment Station Switch Position Chart and follow steps 25 through 37 only.

(b) Before making any adjustments on the P.A., loosen the two screws on the plate tuning knob retaining clip and the set screw on the collar of the grid tuning adjustment.

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
1	PA High Voltage Switch and exciter METER 7 switch	None	Turn power amplifier high voltage switch off. Output cable from exciter-transmitter must be connected to wattmeter and load, not to power amplifier. Reclamp the tube per Step 7 in the Power Amplifier Tube Removal Procedure. (Refer to Service Aids in the Power Amplifier Section.) Place the METER 7 switch on the exciter in the FINAL position if exciter is equipped with this switch.
2	C109, C108, C102, C106	None	Using blade end of tuning tool A, turn C108 and C109 counterclockwise to stop. Use screwdriver end of tuning tool B; turn C102 and C106 counterclockwise to stop.
3	T101, L101, L102, T102	None	Use hex end of tuning tool B. Slugs should be set at lower end ("printed circuit board end") of coil form.
4	T103 Primary	None	Use hex end of tuning tool B. Lower tuning slug should be set at lower end of coilform near printed circuit board.
5	T103 Secondary	None	Use hex end of tuning tool A. Upper tuning slug should be set at upper end of coil form near top of can.
6	---	None	OSCILLATOR - FCC regulations require a periodic frequency check. If the check is due at this time, follow the IDC Adjustment Procedure; OTHERWISE NO ADJUSTMENT SHOULD BE MADE.
7	---	None	Select lowest operating frequency.
8	T101, L101	1	FIRST AMPLIFIER OUTPUT - MODULATOR - Use hex end of tuning tool. Tune T101, L101, T101 in that order for maximum reading. Only a small meter indication (approximately .5 ua) will be observed when tuning T101. Choose first peak for tuning (slug nearest printed circuit board).
9	L102	1	2ND AMPLIFIER INPUT - Use hex end of tuning tool. Tune for minimum reading. Choose first dip (slug nearest printed circuit board).
10	T102	2	TRIPLER OUTPUT - Use hex end of tuning tool. Tune for maximum reading. Slug should be approximately in center of coil form.
11	T103 Primary	2	DOUBLER OUTPUT - Use hex end of tuning tool. Tune for minimum reading. Choose first dip (slug nearest printed circuit board).

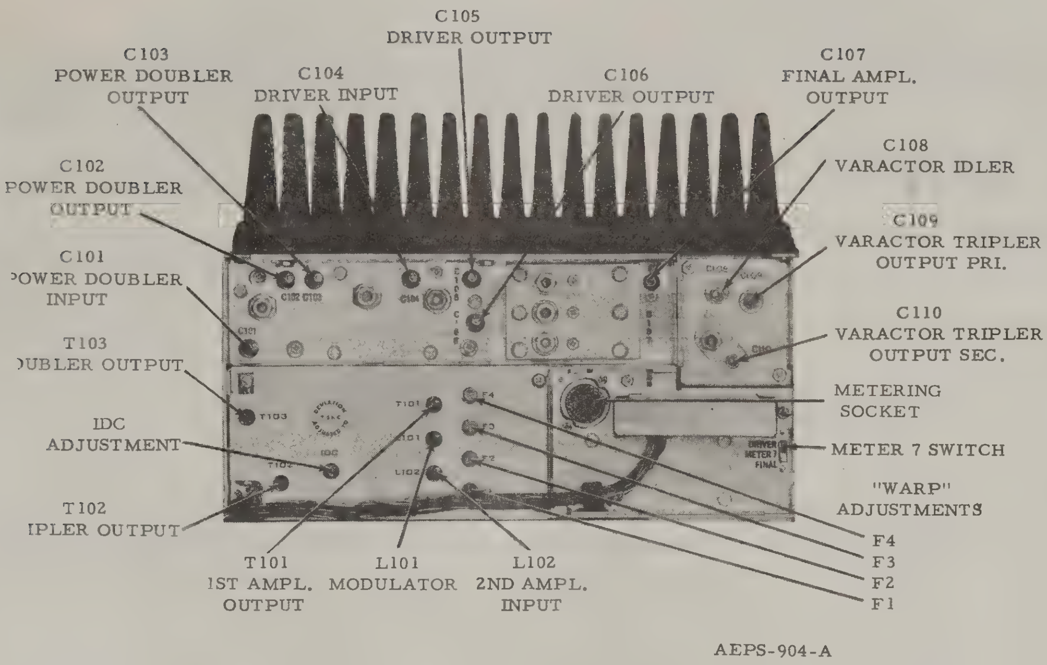


Figure 1.
Exciter-Transmitter Alignment Detail

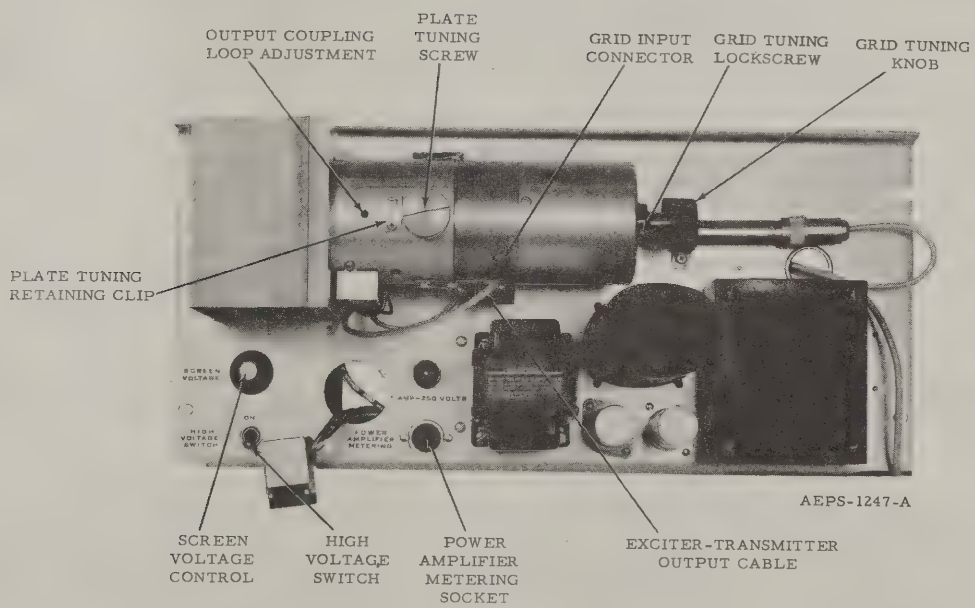


Figure 2.
Power Amplifier Alignment Detail

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
12	T103 Secondary	3	DOUBLER OUTPUT - Use hex end of tuning tool A. Tune for maximum reading. Choose first peak (slug farthest from printed circuit board).
13	T103 Primary	3	DOUBLER OUTPUT - Use hex end of tuning tool. Tune for maximum reading.
14	C103, C101	5	POWER DOUBLER OUTPUT & INPUT - Use screwdriver end of tuning tool. Tune C103 and C101 in that order, for maximum reading.
15	C103, C102	5	POWER DOUBLER OUTPUT - Use screwdriver end of tuning tool. Tune C103 and C102 (turning C102 clockwise) in that order for a maximum reading. Repeak C103 and C102 in that order for maximum reading.
16	C105, C106	6	DRIVER OUTPUT - Use screwdriver end of tuning tool. Tune C105 and C106 in that order for maximum reading. (Turning C106 clockwise.) If at any time while tuning, a meter reading drops abruptly, due to the current limiter protection circuits, it may be necessary to rekey the transmitter while varying the tuning control.
17	C104	6	DRIVER INPUT - Use screwdriver end of tuning tool. Tune C104 for a minimum reading without being an abrupt dip.
18	C107	PA	FINAL AMPLIFIER OUTPUT - Use screwdriver end of tuning tool. Tune for minimum reading without being an abrupt dip.
19	C109	Wattmeter	VARACTOR TRIPLER OUTPUT PRIMARY - Using tuning tool A, turn C109 clockwise for maximum reading.
20	C110	Wattmeter	VARACTOR TRIPLER OUTPUT SECONDARY - Tune for maximum reading.
21	C104, C105, C106, C107	Wattmeter	Tune C104, C105, C106 and C107 in that order for maximum reading.
22	C109	Wattmeter	Tune for maximum reading.
23	C108	Wattmeter	VARACTOR IDLER - Rotate C108 fully clockwise and return counterclockwise for a maximum reading.
24	---	---	Remove metering plug from exciter-transmitter metering socket, and plug it into the power amplifier metering socket. Connect exciter-transmitter output cable to the power amplifier grid. (See Figure 2.) Connect wattmeter to the power amplifier output. Use a 5-1/2" cable to connect the wattmeter to the power amplifier.
25	PA Grid Tuning Knob	6 on PA	Tune the PA grid tuning knob for maximum reading with high voltage switch OFF.
26	Plate Tuning Screw	Wattmeter	Turn the high voltage switch to the "on" position and turn the plate tuning screw for a maximum reading.
27	Output Coupling Loop	Wattmeter	CAUTION: DO NOT INSERT METAL SCREWDRIVER INTO OUTPUT COUPLING LOOP HOLE. Insert the longer screwdriver end of tuning tool C into the plate cavity and adjust the output coupling loop for a maximum reading.

ALIGNMENT CONTINUED ON REVERSE SIDE

For Instruction Manuals

68P81002E30-A 68P81002E35-A
68P81002E40-A 68P81002E45-C
68P81006E60-O 68P81006E70-A
68P81011E70-O 68P81011E75-A
68P81011E80-O 68P81011E85-O
68P81056A30-A 68P81056A35-A

450-470 MHz BASE STATIONS and REPEATER (RT) STATIONS

Replace the Transmitter Alignment Procedure EPS-1156 with this Transmitter Alignment Procedure EPS-1156-F.

H. TRANSMITTER ALIGNMENT PROCEDURE (CONT'D)

STEP	ADJUSTMENT	TEST SET SWITCH POSITION	STAGE AND TUNING PROCEDURE
28	Screen Voltage	PA	Turn the screen voltage control clockwise until PA meter reads 25 ua.
29	Grid Tuning Knob, Plate Tuning Screw, Output Coupling Loop	Wattmeter	Alternately tune the Grid Tuning Knob, the Plate Tuning Screw, and the Output Coupling Loop, in that order, for a maximum reading. Repeat until power output does not increase with retuning.
30	Screen Voltage	PA B+	Note the plate voltage (B+ meter). Increase or decrease the screen voltage until (PA Meter reading) x 10, 000 = Table 1 value of I_p.
31	Screen Voltage	PA B+	If the plate voltage has changed from that noted in Step 30, repeat Step 30 using the new value of plate voltage.
32			Repeat Steps 29, 30 and 31.
33	C110, C109, C108, C107	6 on PA	Tune C110, C109, C108 and C107 in that order on the exciter-transmitter for maximum reading.
34	C107	PA (METER 7 switch in FINAL)	Replace metering cable in exciter-transmitter metering socket. Turn C107 such that PA meter READING DECREASES 3 ua from the initial reading. If after reducing current 3 ua, current is still greater than 40 ua, reduce to 40 ua.
35	T103	3	Use hex end of tuning tool. Tune primary and secondary slugs for maximum reading.
36	C106	PA (METER 7 switch in DRIVER)	If exciter has a METER 7 switch, place in DRIVER position. If meter reads above 15 ua, turn C106 counterclockwise for a 15 ua reading.
37	Grid Tuning Knob	Wattmeter	Adjust grid tuning knob for maximum power output.
38			Carefully tighten the plate tuning knob retaining clip screws and the set screw on the grid tuning adjustment collar of P.A. DO NOT apply excessive force to the screws. C54 and C74 alignment is complete.

TABLE 1.
POWER INPUT

*180 WATT DC POWER INPUT
(For 90-Watt Models)

PLATE VOLTAGE (B+ Meter)	PLATE CURRENT (PA Meter 7 x 10, 000)
525 V	217 mA
550 V	238 mA
575 V	253 mA
600 V	270 mA
625 V	288 mA
650 V	276 mA
675 V	266 mA
700 V	257 mA
725 V	250 mA
750 V	240 mA
775 V	232 mA
800 V	225 mA
825 V	218 mA
850 V	212 mA
875 V	206 mA
900 V	200 mA

120 WATT DC POWER INPUT
(For 60-Watt Models)

PLATE VOLTAGE	PLATE CURRENT (PA Meter 7 x 10, 000)
440 V	272 mA
460 V	261 mA
480 V	250 mA
500 V	240 mA
520 V	230 mA
540 V	222 mA
560 V	214 mA

*Note: When the line voltage to the station is 120 V ac or greater, the standard dc plate input power (180 watts) is used as the E_p, I_p product (E_p x I_p = 180 W). When the line voltage is below nominal during tune-up, the TABLE 1 values of E_p, I_p must be used to avoid exceeding maximum plate and screen current specifications during line voltage variations. When aligning the amplifier at plate voltages below 700 volts the power output may be less than 90 watts. The alignment procedur does insure that, at nominal line conditions, 90 watts of output is achieved at 180 watts input.

I. FINAL METER READINGS

1. Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
2. All readings given in the tables below are minimum except FINAL AMPLIFIER CURRENT, DRIVER CURRENT and PA CURRENT which are maximum. DO NOT exceed the value given for the PA current. Multiply the microampere scale reading by 1/10 to obtain actual FINAL AMPLIFIER COLLECTOR current and DRIVER CURRENT in amperes. Multiply the microampere scale reading by 10 to obtain PA current in milliamperes.
3. Readings 1, 2, 3, 5, and 6 in the exciter-transmitter chart are purely relative and do not give actual current or voltage measurement.

EXCITER-TRANSMITTER FINAL METER READINGS
(Test Set cable inserted into J21 on Exciter-Transmitter)

CIRCUIT METERED	Modulator 1st Amp.	Tripler	Doubler	Power Doubler	Driver	Final Amp. Current	Driver Current
SWITCH POSITION	1	2	3	5	6	7	7
METER READING	16	20	20	10	15	40	15

POWER AMPLIFIER FINAL METER READINGS
(Test Set cable inserted into J22 on Power Amplifier)

CIRCUIT METERED	Grid Drive	PA Current
SWITCH POSITION	6	7
METER READING	13	30

J. OSCILLATOR FREQUENCY ADJUSTMENT

1. TEMPERATURE COMPENSATED OSCILLATOR FREQUENCY

The channel element oscillator is pre-adjusted at the factory to operate within ±0.0002% of the assigned channel frequency from -30°C (-22°F) to +60°C (140°F). The reference point is 25°C (77°F) at which the transmitter oscillator frequency is set exactly on the assigned channel frequency. AT TEMPERATURES OTHER THAN 25°C THE OSCILLATOR WILL NOT OPERATE EXACTLY ON THE ASSIGNED FREQUENCY. The Channel Element Oscillator Temperature Correction Curve (Figure 3) gives the frequency offset required for a given channel element at a given temperature.

For example, if the temperature of the channel element is +40°C, an oscillator with a "C" channel element should be warped down 0.6 parts per million (ppm) or 280 Hz from the assigned center frequency; at +10°C it should be warped up 0.3 ppm or 140 Hz from the assigned frequency. The letter of the channel element is stamped on the edge of the housing. The amount of correction required at a given temperature is expressed both in ppm and in Hz (at 460 MHz) on the correction curve. This correction in Hz can be used for any carrier frequency in the 450-470 MHz range. A correction of 280 Hz is expressed in MHz as 280 x 0.000001 = 0.000280 MHz. Thus, if the curve shows that the oscillator should be warped down 0.6 ppm and the assigned frequency is 465.025 MHz, the oscillator should operate at 465.02500 MHz less 0.000279 MHz or 465.02472 MHz. THE OSCILLATOR MUST BE SET ON THE FREQUENCY SPECIFIED BY THE CORRECTION CURVE FOR A GIVEN TEMPERATURE IN ORDER TO BE WITHIN FCC FREQUENCY SPECIFICATIONS OVER THE ENTIRE TEMPERATURE RANGE.

NOTE

The best accuracy in setting frequency is obtained with channel element temperature near 25°C. In any case the frequency should not be adjusted if the temperature of the channel element is not between +10°C (50°F) and +40°C (104°F).

The channel element temperature can be determined by measuring with a surface-type thermometer placed on the rear shield next to the channel element. A sufficient time must be allowed for the module temperature to stabilize after the station cabinet doors are opened. Stabilization of the channel element temperature (as indicated by the thermometer reading remaining constat) will usually take place in 15-30 minutes or less depending on the particular installation. The temperature to use with Figure 3 will be the channel element temperature plus 1°C (or 2°F).

2. CHANNEL ELEMENT OSCILLATOR FREQUENCY ADJUSTMENT

NOTE

DO NOT ADJUST CHANNEL ELEMENT UNTIL PROPER FREQUENCY HAS BEEN DETERMINED AS DESCRIBED IN THE PRECEDING PARAGRAPHS.

a. Connect the heterodyne OUTPUT to the Model S1075B INPUT, using the short coaxial cable provided.
b. Set the heterodyne selector switch to the 405-475 MHz range.
c. Set the frequency meter selector switch to either the 100 Hz or the 10 Hz position. With 10 Hz resolution, the first digit of the frequency readout will not appear on the display.
d. Attach the antenna provided with the frequency meter to the appropriate 405-475 MHz input on the heterodyne unit, depending on the rf output of the transmitter under test.
e. Read the frequency indication displayed on the digital readout. In multi-frequency models, make certain that the frequency selector switch is in the desired positio

f. Adjust the appropriate channel element frequency warp adjustment (see Figure 1) until the Digital Meter reads the proper frequency as determined in the preceding explanation of the temperature compensated oscillator frequency.

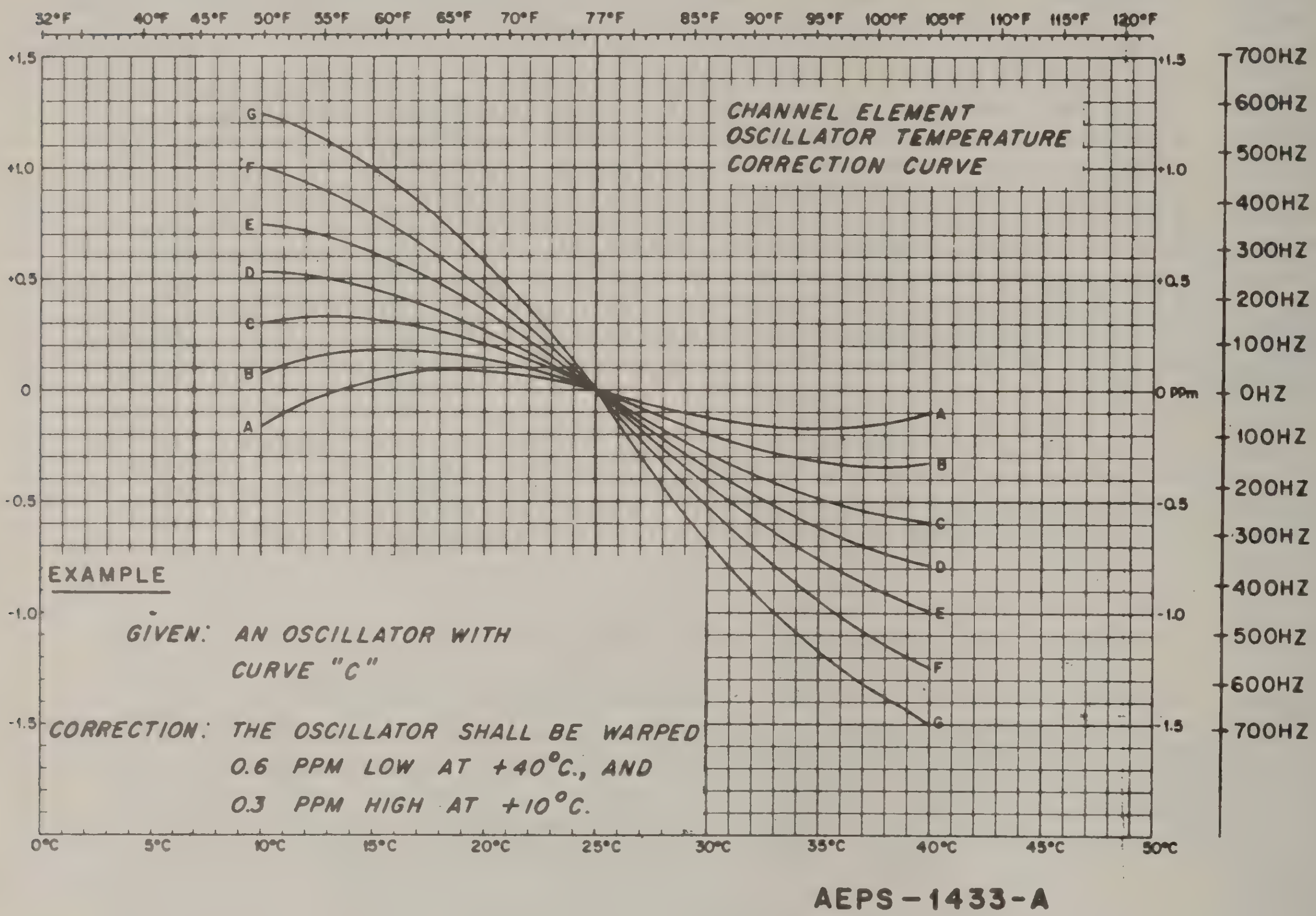
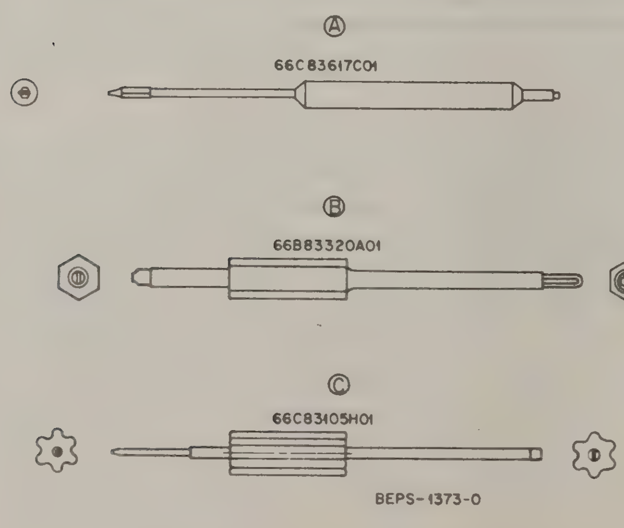


Figure 3.
Oscillator Temperature Correction Curve
(TLN1190A Channel Element)

TRANSMITTER ALIGNMENT TOOLS



MOTOROLA

INSTRUCTION MANUAL REVISION

SMR-1615R

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81011E75-A 450-470 MHz Base Station FM Radio

REVISION DETAILS:

1. F2 CONTROL MODULE

Schematic Diagram Affected: 63P81004E94-B

Models Affected and New Suffix: TLN1246A (TLN4044A-3)

Circuitry Change:

Diode CR7 (Motorola Part No. 48C82392B03) is added in series with resistor R6 and collector of Q1 (cathode is connected to Q1).

2. C2-R2 CONTROL MODULE

Schematic Diagram Affected: 63P81004E99-C

Models Affected and New Suffix: TLN1248A (TLN4048A-4)

Circuitry Change:

Diode CR14 (Motorola Part No. 48C82392B03) is added in series with resistor R6 and collector of Q1 (cathode is connected to Q1).

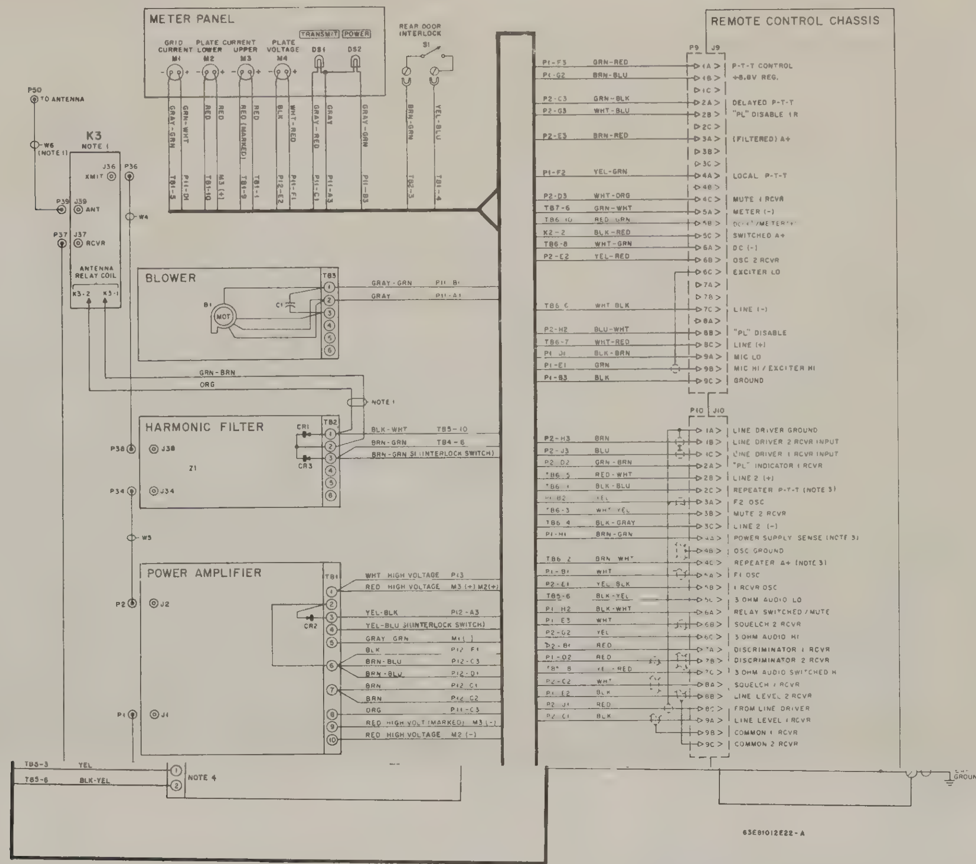
3. PAGING CONTROL MODULE

Schematic Diagram Affected: 63P81005E17-D

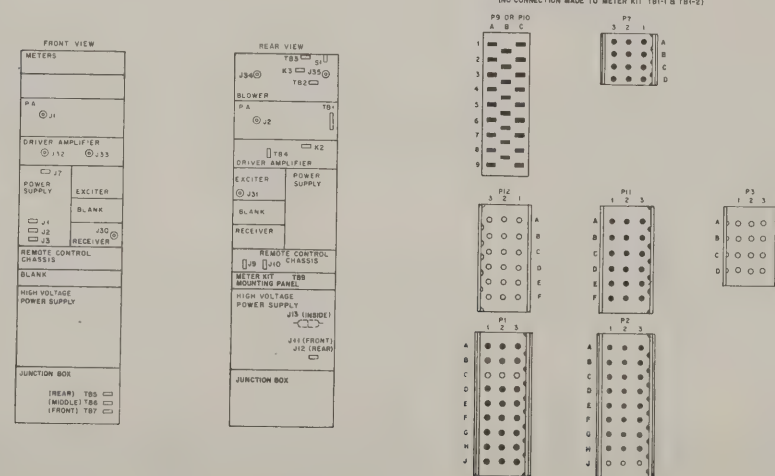
Models Affected and New Suffix: TLN1253A (TLN4044A-3)

Circuitry Change:

Diode CR7 (Motorola Part No. 48C82392B03) is added in series with resistor R6 and collector of Q1 (cathode is connected to Q1).



NOTE
1. BASE STATION MODELS ONLY.
2. DIRECTLY CONNECTED TO DRIVER AMPL. MODULE
3. REPEATER STATION MODELS ONLY
4. WHEN OPTIONAL METER KIT IS INSTALLED CONNECT YEL-BLK TO TB9-2 CONNECT YEL TO TB9-1 (NO CONNECTION MADE TO METER KIT TB1-1 & TB1-2)



PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

450-470 MHz 250/275 W RF Power
Tone Remote Control
Base & Repeater Stations
Intercabling Diagram
Motorola No. 63E81012E22-A (SMR-1022B)
5/21/71-UP

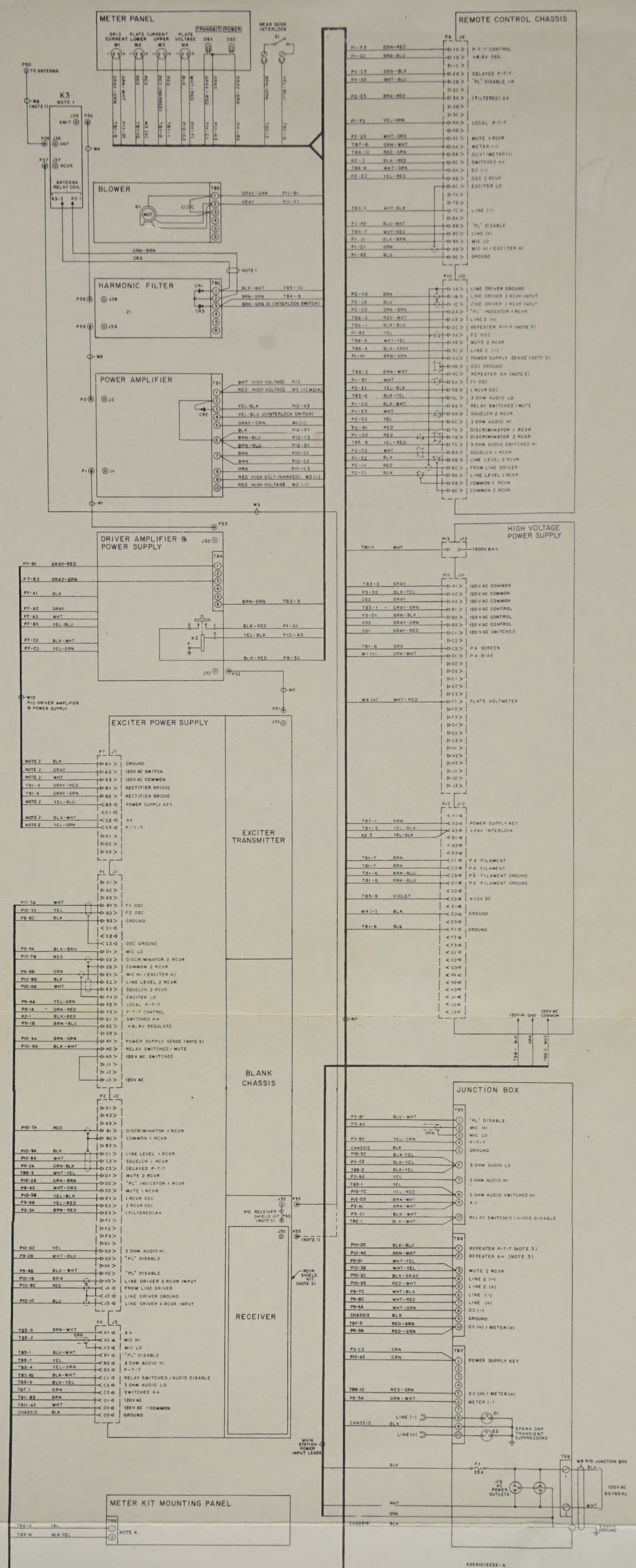
3. PAGING CONTROL MODULE

Schematic Diagram Affected: 63P81005E17-D

Models Affected and New Suffix: TLN1253A (TLN4044A-3)

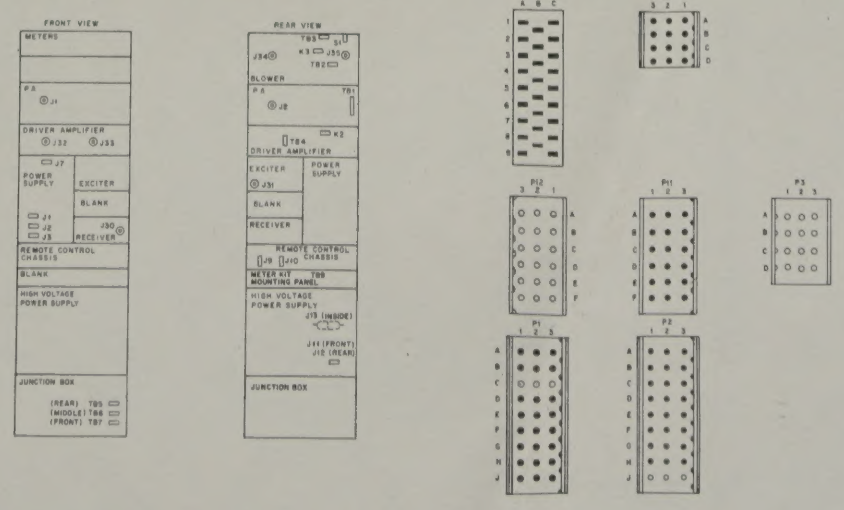
Circuitry Change:

Diode CR7 (Motorola Part No. 48C82392B03) is added in series with resistor R6 and collector of Q1 (cathode is connected to Q1).



63E81012E22-A

NOTE:
1. BASE STATION MODELS ONLY.
2. DIRECTLY CONNECTED TO DRIVER AMPL. MODULE.
3. REPEATER STATION MODELS ONLY.
4. WHEN OPTIONAL METER KIT IS INSTALLED
CONNECT YEL-BLK TO TB9-2
CONNECT YEL TO TB9-1
(NO CONNECTION MADE TO METER KIT TB1-1 & TB1-2)



PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

450-470 MHz 250/275 W RF Power
Tone Remote Control
Base & Repeater Stations
Intercabling Diagram
Motorola No. 63E81012E22-A (SMR-1022B)
5/21/71-UP

INSTALLATION & OPERATION

PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TKN6497A Cable Kit (DC Carrier & "Private-Line" Controlled Base Station) PL-1252-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode:
CR1	40C82466H02	silicon
CR2	40C82466H02	silicon
CR3	40C82466H02	silicon
		ARRESTOR:
E1	80B83029H01	electrical surge (spark gap)
E2	80B83029H01	electrical surge (spark gap)
		CONNECTOR, plug; coaxial:
P1	28B82398E02	male; right angle; type "N"
P2	28A808256	male; type "N"
P33	28K852527	male; type "N"
P34	28A808256	male; type "N"
P35	28K844859	male; right angle; type "N"
P36	28A808256	male; type "N"
P37	28K852527	male; type "N"
		CONNECTOR, plug: phono;
P30	28B82331G01	male
		CONNECTOR, plug:
P1		incl. 14C82337A11 BODY (27-hole); 29C82335A01 TERMINAL contact, male; 15B83934A01 SHELL
P2		incl. 14C82337A11 BODY (27-hole); 29C82335A01 TERMINAL contact, male; 15B83934A01 SHELL
P3		incl. 14C83783A05 BODY (12-hole); 29C82335A01 TERMINAL, contact; male; 15C83934A07 SHELL
P9		incl. 14C83833H01 BODY (27-hole); 29C82013H02 TERMINAL contact, male; 15B83096H01 SHELL
P10		incl. 14C83833H01 BODY (27-hole); 29C82013H02 TERMINAL contact, male; 15B83096H01 SHELL
P11		incl. 14C82337A07 BODY (18-hole, flanged), 29C82335A01 TERMINAL, contact; male
P12		incl. 14C83783A01 BODY (18-hole); 29C82335A01 TERMINAL, contact, male
		TERMINAL BOARD:
TB9	31K481998	2 screw terminals; coded 1 & 2
		LINE, RF transmission:
W1	30B83182A01	CABLE, RF: coaxial; 43" length req'd
W3	30B83182A01	CABLE, RF: coaxial; 100" length req'd
W4	30B852190	CABLE, RF: coaxial; 20" length req'd
W5	30B852190	CABLE, RF: coaxial; 12" length req'd
		CABLE ASSEMBLY, special purpose:
W7		miscellaneous leads, laced
		NON-REFERENCED ITEM
	TLN4503A	MOUNTING PANEL: meter kit

TLN4499A Blower PL-1253-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	8D83987A03	2 uF ±10%; 600 V dc; oil
		BLOWER & MOTOR:
B1	SP7010062A	Blower and Motor
		NON-REFERENCED ITEM
	35C82754G01	FILTER SCREEN

TLN4500A Meter Panel PL-1254-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LIGHT, indicator: neon;
DS1	65B82296H01	incl. lamp and RED lens
DS2	65B82296H02	incl. lamp and AMBER lens
		AMMETER, DC:
M1	72D84865B03	500 uA
M2	72D84865B05	500 mA
M3	72D84865B05	500 mA
		VOLTMETER, DC:
M4	72D84865B04	200 V; 100 mA
		NON-REFERENCED ITEMS
	61C84540C01	PANE, glass
	13B83155C01	GRILLE, speaker

TLN4501A Antenna Relay Kit PL-1255-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		RELAY, antenna:
K3	80D84654C01	12 V; coaxial; spst
		LINE, RF transmission;
W6	30B852190	CABLE, RF: coaxial; 48" length req'd
		CONNECTOR, plug; coaxial:
P39	28A828256	male; type "N"
P50	28A828256	male; type "N"

1V80701B81 Cable Assembly (p/o Driver Amplifier) PL-1256-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LINE, RF transmission;
W2	30C82921H01	CABLE, RF: coaxial; 35" length req'd
		CONNECTOR, plug: coaxial;
P31	28B82331G01	male; miniature type
P32	28B82331G01	male; miniature type

TLN4433A Cabinet Accessories PL-1031-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		FUSE, plug:
F1	65B83099A07	standard screw-base type; 20 A; 125 V
		SWITCH, sensitive:
S1	40B84188A01	door "interlock"; spst

TLN4498AV Junction Box PL-1267-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, receptacle:
J13	9A891865	female dual unit; each section 3-contact
		TERMINAL BOARD:
TB5	31B848187	10 screw terminals
TB6	31B848187	10 screw terminals
TB7	31B848187	10 screw terminals
TB8	31A50378	dual screw terminals
		CABLE ASSEMBLY:
W8	1V80781A84	3-conductor cable and a molded-on 3 cond male plug; length 9 ft.
		FUSEHOLDER:
XF1	9C83122C01	standard screw-base type

TLN1386A Filter & Panel PL-1258-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		FILTER,
Z1	TLN6040A	Harmonic Filter
		SEMICONDUCTOR DEVICE, diode:
CR1	40C82466H02	silicon
CR3	40C82466H02	silicon

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
LN1386A Filter & Panel		PL-1258-O
Z1	TLN6040A	FILTER, Harmonic Filter
		SEMICONDUCTOR DEVICE, diode:
CR1	40C82466H02	silicon
CR3	40C82466H02	silicon